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EPA Superfund
Record of Decision:

TRI-CITY DISPOSAL CO.
EPA ID: KYD981028350
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SHEPHERDSVILLE, KY
08/28/1991

AUGUST 28, 1991
REGIONAL ADMINISTRATOR

DECISION SUMMARY

TRI-CITY INDUSTRIAL DISPOSAL SITE
BROOKS, BULLITT COUNTY, KENTUCKY

#SLD

1.0 SITE LOCATION AND DESCRIPTION

1.1 SITE LOCATION

THE TRI-CITY INDUSTRIAL DISPOSAL SUPERFUND SITE (THE "SITE") IS LOCATED IN THE COMMUNITY OF BROOKS IN NORTH-CENTRAL BULLITT COUNTY, KENTUCKY, APPROXIMATELY 15 MILES SOUTH OF LOUISVILLE (SEE FIGURE 1). THE SITE CONSISTS OF APPROXIMATELY 349 ACRES AND IT IS LOCATED ON THE SOUTH SIDE OF STATE HIGHWAY 1526 (ALSO KNOWN AS BROOKS HILL ROAD), APPROXIMATELY FOUR MILES WEST OF US INTERSTATE 65 (SEE FIGURE 2). THE GEOGRAPHICAL COORDINATES FOR THE SITE ARE 38 DEGREES FAHRENHEIT 2'50.9" NORTH LATITUDE AND 85 DEGREES FAHRENHEIT 46'06.1" WEST LONGITUDE.

1.2 SITE DESCRIPTION

THE SITE IS LOCATED IN THE BLUE GRASS REGION OF THE INTERIOR LOW PLATEAUS PHYSIOGRAPHIC PROVINCE. THE BLUE GRASS REGION LIES WITHIN THE OHIO RIVER DRAINAGE BASIN AND IT IS AN AREA OF GENERALLY ROLLING UPLANDS RANGING IN ELEVATION FROM LESS THAN 800 FEET ABOVE MEAN SEA LEVEL (MSL) IN THE NORTHWEST TO ABOUT 1000 FEET IN THE SOUTHEAST. THE SITE IS WITHIN THE KNOBS REGIONAL SUBDIVISION OF THE BLUE GRASS REGION.

THE CLIMATE IN THE BLUE GRASS REGION IS MODERATE WITH A MEAN ANNUAL TEMPERATURE OF 67 DEGREES FAHRENHEIT THE AVERAGE ANNUAL SUMMER TEMPERATURE IS 75 DEGREES FAHRENHEIT, AND THE AVERAGE ANNUAL WINTER TEMPERATURE IS 35 DEGREES FAHRENHEIT THE AVERAGE ANNUAL PRECIPITATION IN BULLITT COUNTY IS 55 INCHES AND THE MEAN ANNUAL LAKE EVAPORATION IS 35 INCHES, RESULTING IN A NET PRECIPITATION OF 20 INCHES.

APPROXIMATELY 300 PEOPLE LIVE WITHIN ONE MILE OF THE SITE. THE SITE AND SURROUNDING AREA ARE RURAL AND THE LAND USE IS PREDOMINANTLY AGRICULTURAL AND RESIDENTIAL. SEVERAL RESIDENCES EXIST ON AND ADJACENT TO FORMER DISPOSAL AREAS AT THE SITE, AND A PORTION OF THE SITE IS USED FOR AGRICULTURAL PURPOSES (I.E., PASTURES AND SMALL GARDENS). OTHER AREAS OF THE SITE ARE COVERED WITH GRASS AND TREES.

NOTABLE SURFACE FEATURES ON-SITE INCLUDE A SHALLOW TRENCH PARTIALLY FILLED WITH WATER AT THE SOUTHERN END OF THE SITE THAT IS APPROXIMATELY 240 FEET LONG AND 80 FEET WIDE, AND TWO SHALLOW PONDS (EACH LESS THAN 1/8 OF AN ACRE), WHICH ARE USED TO WATER LIVESTOCK.

SITUATED ON A BROAD RIDGE KNOWN AS THE BEGHTOL RIDGE, THE SITE SLOPES MODERATELY TO THE SOUTH. THE ELEVATIONS ACROSS THE SITE RANGE FROM 800 FEET TO 840 FEET ABOVE MSL. THE SOUTHERN BOUNDARY AND PORTIONS OF THE EASTERN AND WESTERN BOUNDARIES DROP INTO STEEP, VEGETATED RAVINES HAVING BOTTOM ELEVATIONS RANGING FROM 600 FEET TO 800 FEET ABOVE MSL WITHIN 400 HORIZONTAL FEET FROM THE SITE.

THE ORIGINAL SOILS OF THE SITE ARE CLASSIFIED AS CRIDER SILT LOAMS WHICH ARE FORMED ON LONG, STEEP HILLSIDES AND BROAD, GENTLY SLOPING TO MODERATELY STEEP RIDGETOPS AND SHOULDER SLOPES ABOVE DEEP VALLEYS. CRIDER SOILS ARE DESCRIBED AS DEEP AND WELL DRAINED WITH UPPER LOAMY ZONES AND CLAYEY SUBSOILS.

THE UNDERLYING GEOLOGY OF THE AREA CONSISTS OF LIMESTONES, DOLOMITES, SILTSTONES, AND SILTY SHALES IN THE UPLAND KNOB AREA, AND TERRACE DEPOSITS IN THE LOWLAND VALLEYS. THE GEOLOGIC FORMATIONS UNDERLYING THE SITE INCLUDE, IN STRATIGRAPHIC ORDER (TOP TO BOTTOM), THE SALEM LIMESTONE, THE HARRODSBURG LIMESTONE, AND MEMBERS OF THE BORDEN FORMATION. FIGURE 2 SHOWS THE STRATIGRAPHY OF THE AREA. FORMATION THICKNESS IN THE VICINITY OF THE SITE RANGES FROM 18 TO 25 FEET BASED ON THE GEOLOGIC MAP. KARST FEATURES ARE NOT DEVELOPED AT THE SITE DUE TO THE SIGNIFICANT AMOUNT OF SILTSTONE AND SHALES INTERBEDDED WITHIN THE LIMESTONES UNDERLYING THE SITE.

THE GROUNDWATER AT THE SITE PRIMARILY FLOWS THROUGH FRACTURES AND BEDDING PLANES THAT HAVE BEEN PREFERENTIALLY ENLARGED BY SOLUTIONING AND WHERE DOLOMITIZATION HAS ENHANCED THE POROSITY AND PERMEABILITY OF THE AQUIFER. GROUNDWATER DISCHARGES VIA SPRINGS AND SEEPS THAT SPORADICALLY OCCUR WHERE THE GEOLOGIC UNITS THAT COMPRISE THE AQUIFER ARE EXPOSED. ALTHOUGH THE SPRINGS AND SEEPS IN THE SHALLOW LIMESTONE AQUIFER TEND TO STOP FLOWING DURING DRY PERIODS, THEY DO PRODUCE SUFFICIENT QUANTITIES OF WATER FOR DOMESTIC USE WITH THE ASSISTANCE OF A CISTERN. SPRINGS ARE USED AS WATER SUPPLY SOURCES MORE FREQUENTLY THAN DRILLED WELLS DUE TO THE SPORADIC AND UNPREDICTABLE OCCURRENCE OF WATER IN THE MEMBERS.

THE SITE IS DRAINED TO THE WEST, SOUTH, AND EAST BY BRUSHY FORK CREEK, WHICH IS A PERENNIAL STREAM. THE SPRINGS AND SEEPS AT THE SITE REPRESENT SOURCES OF GROUNDWATER WHICH CONTRIBUTE TO SURFACE WATER RUNOFF TO BRUSHY FORK CREEK. THE SOURCE FOR THE CREEK IS A SMALL SPRING APPROXIMATELY 3,000 FEET SOUTHEAST OF THE SITE AND LOCATED AT AN ELEVATION OF APPROXIMATELY 750 FEET ABOVE MSL. BRUSHY FORK CREEK FLOWS WESTWARD FOR APPROXIMATELY TWO MILES, WHERE IT JOINS KNOB CREEK AND BECOMES PART OF THE OHIO RIVER DRAINAGE NETWORK.

BRUSHY FORK CREEK IS USED SEASONALLY FOR RECREATIONAL PURPOSES AND FOR THE IRRIGATION OF NEARBY CROPS. THE CREEK APPEARS TO BE A HEALTHY STREAM SUPPORTING DIVERSE COMMUNITIES OF MACROINVERTEBRATES AND SMALL FISH. ADEQUATE FEEDING HABITAT FOR ENDANGERED SPECIES OF BATS AND THE BALD EAGLE WERE DETERMINED TO NOT EXIST WITHIN THE STREAM REACH OF BRUSHY FORK CREEK AND THE TRIBUTARIES WHICH ARE AFFECTED BY THE SITE.

THE SITE IS NOT LOCATED IN A 100-YEAR FLOODPLAIN. AND, THE US FISH AND WILDLIFE SERVICE (FWS) HAS DETERMINED THAT BRUSHY FORK CREEK IS NOT A HABITAT FOR ENDANGERED SPECIES. THE FWS HAS ALSO DETERMINED THAT THE SITE IS NOT ON A WETLAND, NOR DOES IT AFFECT A WETLAND.

#SHEA

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORY

THE SITE WAS AN INDUSTRIAL WASTE LANDFILL KNOWN TO HAVE BEEN OPERATED BY TRI-CITY INDUSTRIAL SERVICES, INC. FROM LATE 1964 TO LATE 1967. THE MAJORITY OF THE MATERIAL REPORTEDLY DISPOSED OF AT THE SITE WAS INDUSTRIAL IN ORIGIN FROM SEVERAL LOUISVILLE, KENTUCKY INDUSTRIES. THE BULK OF THE WASTE CONSISTED OF SCRAP LUMBER AND FIBERGLASS INSULATION MATERIALS. THE REMAINING WASTE CONSISTED OF DRUMMED LIQUID WASTES AND BULK LIQUIDS THAT WERE POURED ONTO THE GROUND. IN 1968, STATE OFFICIALS REPORTED THAT HIGHLY VOLATILE LIQUID WASTES RESEMBLING PAINT THINNERS WERE DISPOSED OF ON-SITE.

RECORDS INDICATE THAT A SITE ATTENDANT WAS PRESENT AT THE SITE AT LEAST DURING A PORTION OF THE TIME THE LANDFILL WAS OPERATED. THE DUTIES OF THE SITE ATTENDANT INCLUDED PUSHING EACH DAY'S COLLECTION OF REFUSE OVER THE WORKING FACE OF THE LANDFILL INTO THE SURROUNDING RAVINES. IN AT LEAST ONE INSTANCE, THE ATTENDANT WAS INSTRUCTED TO POUR LIQUID WASTE MATERIAL DIRECTLY ONTO THE GROUND TO HELP ALLEVIATE FIRE AND EXPLOSION HAZARDS.

THE SITE WAS A SOURCE OF LOCAL CITIZEN COMPLAINTS AND CONCERNS TO STATE AND COUNTY GOVERNMENT OFFICIALS ON NUMEROUS OCCASIONS DURING THE DISPOSAL OPERATIONS. IN 1965, RESIDENTS NEAR THE SITE FIRST COMPLAINED TO LOCAL OFFICIALS REGARDING THE UNKEMPT CONDITION OF THE LANDFILL, EXPLOSIONS, FIRES, AND SMOKE WHICH WAS SAID TO IRRITATE EYES, MAKE BREATHING DIFFICULT, AND HAVE AN OFFENSIVE ODOR. ADDITIONALLY, DEPOSITION OF ASH AND CHARRED DEBRIS ON NEIGHBORING PROPERTIES LED TO A CIVIL LAWSUIT FOR CREATING A PUBLIC NUISANCE.

THE BULLITT COUNTY HEALTH DEPARTMENT, COUNTY ATTORNEY, AND THE COMMONWEALTH OF KENTUCKY DEPARTMENT OF FISH AND WILDLIFE RESOURCES (THEN THE DIVISION OF FISHERIES) ALONG WITH THE DEPARTMENT OF HEALTH (THEN THE DIVISION OF ENVIRONMENTAL HEALTH) INVESTIGATED THESE COMPLAINTS. AN INDICTMENT, SERVED TO TRI-CITY INDUSTRIAL SERVICES, INC. AND OTHERS IN NOVEMBER 1967, RESULTED IN THE ARREST OF THE COMPANY'S PRESIDENT, MR. HARRY KLETTER, ON THE NUISANCE CHARGE. AFTER MR. KLETTER'S ARREST, A SETTLEMENT WAS NEGOTIATED WHEREBY THE CHARGES WOULD BE DROPPED IF THE COMPANY AGREED TO STOP DISPOSING OF AND BURNING WASTE AT THE SITE. AT ABOUT THE SAME TIME AS THE ARREST, A FIRE ERUPTED ON THE SITE THAT BURNED FOR TWO YEARS. TRI-CITY INDUSTRIAL SERVICES, INC. REPORTEDLY CEASED ALL WASTE DISPOSAL ACTIVITY SHORTLY AFTER THE FIRE BEGAN.

2.2 INITIAL INVESTIGATIONS

EPA'S INVOLVEMENT WITH THE SITE COMMENCED IN SEPTEMBER 1985 FOLLOWING NOTIFICATION BY THE KENTUCKY NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET (THE "CABINET"). THE CABINET CONDUCTED A PRELIMINARY ASSESSMENT (PA) OF THE SITE IN SEPTEMBER 1985 AND RECOMMENDED A HIGH PRIORITY FOR INSPECTION. THE CABINET PERFORMED A SITE INVESTIGATION (SI) IN APRIL 1987 TO DETERMINE THE SITE'S ELIGIBILITY FOR INCLUSION ON EPA'S NATIONAL PRIORITY LIST (NPL). THE INVESTIGATION INCLUDED IDENTIFICATION OF SEVERAL PRIVATE, POTABLE WATER SUPPLIES NEAR THE SITE AND MULTI-MEDIA SAMPLING (WASTE, SOIL, AND GROUNDWATER). SEVERAL HAZARDOUS SUBSTANCES WERE DETECTED IN ON-SITE SOILS AND WASTES, INCLUDING PCBS, PHENOLS, HEAVY METALS, AND VARIOUS ORGANIC COMPOUNDS. ONE RESIDENTIAL SPRING, UTILIZED BY THE KLAPPER FAMILY AS A SOURCE OF POTABLE WATER, LOCATED SEVERAL HUNDRED YARDS WEST OF THE SITE WAS SAMPLED AND IT CONTAINED LEVELS OF TETRACHLOROETHENE (ALSO KNOWN AS PERCHLOROETHYLENE, OR PCE) ABOVE MAXIMUM CONTAMINANT LEVELS (MCLS).

FOLLOWING THE CABINET'S RELEASE OF THE SAMPLING RESULTS, EPA CONDUCTED ADDITIONAL SAMPLING AND PROVIDED AN ALTERNATE WATER SUPPLY TO THE TWO KLAPPER RESIDENCES IN MAY 1988. EPA ALSO DISCOVERED THAT ANOTHER SPRING CLOSER TO THE SITE WAS BEING USED AS A SOURCE OF POTABLE WATER BY MR. AND MRS. WILLIAM D. COX, SR. BOTTLED WATER WAS SUPPLIED TO THE COX, SR. RESIDENCE UNTIL SAMPLING RESULTS WERE OBTAINED. SAMPLING OF THE COX SPRING WAS INCLUDED IN A MAY 1988 SURVEY OF POTABLE WATER SOURCES CONDUCTED BY EPA WITHIN AN APPROXIMATE ONE-HALF MILE RADIUS OF THE SITE. THE SAMPLING CONFIRMED AGAIN THE PRESENCE OF PCE IN THE KLAPPER SPRING, AND ELEVATED LEVELS OF PCE AND TRICHLOROETHENE (TCE) WERE FOUND IN THE COX SPRING. THIS SURVEY IDENTIFIED THE TWO KLAPPER RESIDENCES AND THE COX, SR. RESIDENCE AS THE ONLY AFFECTED HOUSEHOLDS WITHIN THE INVESTIGATED AREA. THE PROVISION OF BOTTLED WATER TO THE COX, SR. RESIDENCE AND TWO KLAPPER RESIDENCES IS AN ONGOING ACTION FUNDED BY EPA.

THE FINDINGS OF THE POTABLE WATER SURVEY PROMPTED EPA TO CONDUCT AN ADDITIONAL STUDY IN JUNE 1988, THE EMPHASIS OF WHICH WAS TO ASSESS THE SITE'S POTENTIAL IMPACT ON AREA RESIDENTS VIA INGESTION OF GROUNDWATER, INHALATION OF SOIL PARTICULATES, AND DIRECT CONTACT. SAMPLE LOCATIONS INCLUDED SENSITIVE AREAS SUCH AS YARDS, GARDENS, AND POTABLE WATER SUPPLIES. SAMPLES COLLECTED INCLUDED FIVE COMPOSITE SURFACE SOIL SAMPLES, THREE WASTE SAMPLES, AND FOUR GROUNDWATER SAMPLES.

THE SITE WAS PROPOSED FOR INCLUSION ON THE NPL ON JUNE 24, 1988 (53 FR 23988) BASED PRIMARILY ON THE POTENTIAL HAZARD FROM CONTAMINATED GROUNDWATER. THE SITE BECAME FINAL ON THE NPL ON MARCH 31, 1989 (54 FR 13302) WITH A HAZARD RANKING SCORE (HRS) OF 33.82.

2.3 REMOVAL ACTIONS

THE SITE RECEIVED FURTHER ATTENTION IN JUNE 1988 WHEN EPA RESPONDED TO A TELEPHONE CALL FROM THE COX, SR. FAMILY REGARDING A "BLACK OOZE" EMANATING FROM THEIR SIDE YARD. EPA'S TECHNICAL ASSISTANCE TEAM (TAT) CONTRACTOR, ROY F. WESTON, COLLECTED TWO SAMPLES FROM THE REPORTED STAINED AREA AND ALSO FROM A SOLID MATERIAL RESEMBLING PAINT WASTE. THE SAMPLES INDICATED ELEVATED LEVELS OF XYLENE, TOLUENE, ETHYLBENZENE, AND LEAD.

NUS CORPORATION, EPA'S FIELD INVESTIGATION TEAM (FIT) CONTRACTOR, CONDUCTED A GEOPHYSICAL SURVEY AND FIELD ANALYTICAL SCREENING PROCEDURES (FASP) AT THE SITE IN AUGUST 1988 TO DELINEATE WASTE DISPOSAL AREAS AND PROVIDE ADDITIONAL SUBSURFACE INFORMATION. MAGNETOMETRY, RESISTIVITY, AND ELECTROMAGNETIC TERRAIN CONDUCTIVITY SURVEYS WERE PERFORMED DURING THE GEOPHYSICAL INVESTIGATION. THE STUDY AREA IS SHOWN IN FIGURE 4. THE ELECTROMAGNETIC AND MAGNETIC ANOMALIES ARE SHOWN IN FIGURES 5 AND 6, RESPECTIVELY.

TO COMPLEMENT AND SUBSTANTIATE THE INFORMATION COLLECTED DURING THE GEOPHYSICAL SURVEY, FASP WERE ALSO CONDUCTED. THE FASP TECHNIQUES EMPLOYED WERE GAS PROBES AND SUBSURFACE SOIL SAMPLE COLLECTION WITH ANALYSES FOR VOLATILE ORGANIC COMPOUNDS (VOCS). THE LOCATIONS FOR FASP WERE SELECTED FROM THOSE GEOPHYSICALLY ANOMALOUS AREAS YIELDING THE HIGHEST ELECTROMAGNETIC AND MAGNETIC READINGS.

THE RESULTS OF THE FASP STUDY TENDED TO SUBSTANTIATE THE GEOPHYSICAL FINDINGS BY DETECTING VOCS IN SIGNIFICANT CONCENTRATION CLOSE TO THE ANOMALIES. GIVEN THE CORRELATION BETWEEN THE TWO SURVEYS, THE DISPOSAL OF THE WASTE WAS APPARENTLY CONCENTRATED IN THE SOUTHERN HALF OF THE LANDFILL.

BASED ON THE RESULTS OF THE SAMPLING CONDUCTED BY EPA'S TAT CONTRACTOR AND THE PROXIMITY OF THE CONTAMINATION TO THE COX, SR. RESIDENCE, EPA CONDUCTED AN EMERGENCY REMOVAL ACTION IN AUGUST AND SEPTEMBER 1988 TO EXCAVATE AND REMOVE APPROXIMATELY 165 DRUMS (FULL OR PARTIALLY FULL) THAT WERE IN GENERALLY GOOD CONDITION, MANY CRUSHED AND EMPTY DRUMS, METAL CONTAINERS OF VARIOUS SIZES, AUTO PARTS, 400 GALLONS OF FREE LIQUIDS, AND OVER 800 CUBIC YARDS OF SUSPECTED CONTAMINATED SOIL. THE RESULTING TRENCH IN THE SIDE YARD WAS APPROXIMATELY TEN FEET DEEP, TWELVE TO FIFTEEN FEET WIDE, AND THIRTY FEET LONG. AS SHOWN IN FIGURE 7, THE TRENCH EXTENDED NORTHWARD THROUGH A PORTION OF THE DRIVEWAY.

FOLLOWING COMPLETION OF THE REMOVAL TRENCH, NUMEROUS TEST TRENCHES WERE EXCAVATED TO IDENTIFY ADDITIONAL WASTE DISPOSAL AREAS. THE RESULTS OF THE GEOPHYSICAL SURVEYS WERE USED TO AID IN DETERMINING THE TRENCHING LOCATIONS. AS SHOWN IN FIGURE 8, THE TRENCHES WERE EXCAVATED IN THE COX, SR. SIDE YARD, THROUGHOUT A PASTURE EAST OF THE COX, SR. RESIDENCE, AND ON THE HOOSIER'S PROPERTY, WHICH IS A FIVE TO SEVEN ACRE TRACT EAST OF THE PASTURE THAT WAS SOLD BY MR. COX, SR. A LIMITED NUMBER OF EMPTY DRUMS AND DRUMS CONTAINING SOLIDS WERE EXCAVATED AND STAGED, BUT NO ADDITIONAL LIQUIDS WERE LOCATED. PRIMARILY, THE OPERATORS ENCOUNTERED WASTE FIBERGLASS INSULATION AND ASH, INDICATING THE HISTORICAL FIRES. MANY OF THE GEOPHYSICAL ANOMALIES WERE INSULATION AND WIRE. THE TEST EXCAVATION WAS DISCONTINUED IN SEPTEMBER 1988 AND THE TRENCHES WERE BACKFILLED AND GRADED.

2.4 REMEDIAL INVESTIGATION/FEASIBILITY STUDY

EPA BEGAN A REMEDIAL INVESTIGATION (RI) IN JULY 1989 TO CHARACTERIZE THE SITE AND DETERMINE THE NATURE AND EXTENT OF CONTAMINATION. SINCE THE GEOPHYSICAL SURVEY AND FASP INDICATED THAT THE DISPOSAL OF WASTE WAS CONCENTRATED IN THE SOUTHERN HALF OF THE LANDFILL, THE FIELD ACTIVITIES OF THE RI WERE CONCENTRATED IN THAT AREA. FIGURE 9 SHOWS THE RI SAMPLING LOCATIONS WITH RESPECT TO THE APPROXIMATE WASTE DISPOSAL AREAS BASED ON TWO AERIAL PHOTOGRAPHS TAKEN IN MAY 1966 AND JANUARY 1967.

PHASE I OF THE RI WAS PERFORMED IN JULY 1989 AND THE ACTIVITIES INCLUDED SITE TOPOGRAPHIC MAPPING, A SURFICIAL GEOLOGICAL ASSESSMENT, SURFACE WATER AND SEDIMENT SAMPLING, SPRING SAMPLING, SURFACE SOIL SAMPLING, AND AN AQUATIC BIOTA SURVEY. PHASE II OF THE RI WAS CONDUCTED FROM SEPTEMBER TO NOVEMBER 1989 AND THE ACTIVITIES INCLUDED GROUND SURVEYING, TEMPORARY SOIL BORINGS, SUBSURFACE SOIL SAMPLING, SUBSURFACE GEOPHYSICAL INVESTIGATIONS, GROUNDWATER INVESTIGATIONS, AQUIFER TESTS, AND AIR MONITORING. ALL WORK WAS CONDUCTED BY EPA'S REM III CONTRACTOR, EBASCO SERVICES, INC.

DURING THE RI, SIX GROUNDWATER MONITORING WELLS WERE INSTALLED AND SAMPLED. THE INSTALLATION OF SEVEN OTHER WELLS WAS ATTEMPTED, BUT THE WELLS WERE NOT COMPLETED BECAUSE OF INSUFFICIENT GROUNDWATER. FOUR SPRINGS WERE SAMPLED, AND SIX SURFACE WATER SAMPLES WERE TAKEN FROM

BRUSHY FORK CREEK AND THE TWO TRIBUTARIES THAT DISCHARGE TO THE CREEK. TWELVE SEDIMENT SAMPLES WERE COLLECTED IN THE AREAS OF THE SPRINGS AND BRUSHY FORK CREEK. TWENTY SURFACE SOIL SAMPLES AND TWENTY-FIVE SUBSURFACE SOIL SAMPLES WERE COLLECTED. IN ADDITION, SIXTEEN AIR SAMPLES WERE COLLECTED AT THREE LOCATIONS THAT WERE SELECTED BASED ON PREVAILING WIND DIRECTIONS AND THE LOCATIONS OF RESIDENTS.

EPA CONDUCTED ADDITIONAL SAMPLING OF SEVERAL SPRINGS, INCLUDING THE COX AND KLAPPER SPRINGS, AND ONE MONITORING WELL IN DECEMBER 1990 TO VERIFY SAMPLING CONDUCTED DURING THE RI.

EBASCO SERVICES, INC., UNDER EPA'S ALTERNATIVE REMEDIAL CONTRACTING STRATEGY (ARCS) IV CONTRACT, ALSO CONDUCTED THE FEASIBILITY STUDY TO DEVELOP AND EVALUATE REMEDIAL ALTERNATIVES FOR ADDRESSING THE SITE'S KNOWN CONTAMINATION PROBLEMS. THE FS WAS COMPLETED IN APRIL 1991, AND EPA RELEASED THE RI AND FS REPORTS TO THE PUBLIC IN MAY 1991.

THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) WERE NOTIFIED IN WRITING IN NOVEMBER 1988 AND MAY 1989 VIA SPECIAL NOTICE LETTERS AND GIVEN THE OPPORTUNITY TO CONDUCT THE RI/FS WITH EPA OVERSIGHT. HOWEVER, NONE OF THE PARTIES ELECTED TO UNDERTAKE THESE ACTIVITIES.

#HCP

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

A COMMUNITY RELATIONS PLAN (CRP) FOR THE TRI-CITY SITE WAS FINALIZED IN MAY 1989. THIS DOCUMENT INCLUDED A LIST OF CONTACTS AND INTERESTED PARTIES THROUGHOUT GOVERNMENT AND THE LOCAL COMMUNITY. THE CRP ALSO ESTABLISHED COMMUNICATION PATHWAYS TO ENSURE TIMELY DISSEMINATION OF PERTINENT INFORMATION.

A FACT SHEET DESCRIBING THE SITE AND THE NATURE OF THE RI/FS PROCESS WAS DISTRIBUTED TO THE PUBLIC IN MAY 1989. EPA HELD AN AVAILABILITY SESSION IN SHEPHERDSVILLE, KENTUCKY ON JUNE 1, 1989 TO DISCUSS THE RI/FS ACTIVITIES AND SITE-RELATED CONCERNS WITH THE COMMUNITY.

THE RI AND FS REPORTS WERE RELEASED TO THE PUBLIC ON MAY 2, 1991. THE PROPOSED PLAN FACT SHEET, WHICH DESCRIBED EPA'S PREFERRED ALTERNATIVE FOR REMEDIATION OF THE SITE, WAS DISTRIBUTED ON APRIL 19, 1991. THE INFORMATION USED BY EPA TO SELECT A RESPONSE ACTION UNDER CERCLA, INCLUDING THE PREVIOUSLY MENTIONED DOCUMENTS, HAS BEEN INCLUDED IN THE ADMINISTRATIVE RECORD AT THE INFORMATION REPOSITORIES LOCATED IN THE RIDGWAY MEMORIAL LIBRARY IN SHEPHERDSVILLE, KENTUCKY AND THE RECORDS CENTER IN EPA'S REGION IV OFFICE IN ATLANTA, GEORGIA.

A PUBLIC COMMENT PERIOD WAS HELD FROM MAY 2, 1991 TO JUNE 1, 1991. IN ADDITION, A PUBLIC MEETING WAS HELD ON MAY 9, 1991 TO PRESENT THE RESULTS OF THE RI/FS AND TO DISCUSS THE PREFERRED ALTERNATIVE AS PRESENTED IN THE PROPOSED PLAN FACT SHEET FOR THE SITE. ALL COMMENTS RECEIVED BY EPA DURING THE PUBLIC COMMENT PERIOD, INCLUDING THOSE EXPRESSED VERBALLY AT THE PUBLIC MEETING, ARE ADDRESSED IN THE RESPONSIVENESS SUMMARY CONTAINED IN APPENDIX C OF THIS DOCUMENT. THE

COMMENTS FROM THE COMMONWEALTH OF KENTUCKY AND EPA'S RESPONSE ARE INCLUDED IN APPENDIX B.

#SRRA

4.0 SCOPE AND ROLE OF RESPONSE ACTION

THE TRI-CITY SITE HAS BEEN DIVIDED INTO TWO OPERABLE UNITS. OPERABLE UNIT #1 WILL INCLUDE THE REMEDIATION OF CONTAMINATED GROUNDWATER AND CONFIRMATORY SAMPLING TO IDENTIFY ANY UNACCEPTABLE LEVELS OF HAZARDOUS CONTAMINANTS IN AREAS OF THE SITE NOT OTHERWISE ADDRESSED. OPERABLE UNIT #2 WILL INVOLVE THE ADDITIONAL MEASURES NECESSARY TO MITIGATE ANY THREAT TO HUMAN HEALTH OR THE ENVIRONMENT IDENTIFIED DURING THE CONFIRMATORY SAMPLING IN THE FIRST OPERABLE UNIT.

THE REMEDY SELECTED IN THIS ROD IS FOR OPERABLE UNIT #1 AND IT ADDRESSES THE CONTAMINATED GROUNDWATER AS IT DISCHARGES TO THE SPRINGS. CONTAMINATED GROUNDWATER POSES THE KNOWN MAJOR THREAT TO HUMAN HEALTH AND THE ENVIRONMENT AT THE SITE DUE TO THE RISK ASSOCIATED WITH INGESTION OF WATER CONTAINING VOLATILE ORGANIC COMPOUNDS AT LEVELS ABOVE MCLS AND NON-ZERO MAXIMUM CONTAMINANT LEVEL GOALS (MCLGS). INSTITUTIONAL CONTROLS WILL BE IMPLEMENTED TO RESTRICT POTABLE USAGE AND MONITOR SPRINGS IN THE AREA OF THE SITE UNTIL THE WATER IS OF SUFFICIENT AND CONSISTENT QUALITY FOR HUMAN CONSUMPTION. POTABLE WATER WILL CONTINUE TO BE PROVIDED TO AFFECTED RESIDENTS.

OPERABLE UNIT #1 ALSO INCLUDES CONFIRMATORY SAMPLING OF SITE SOILS, SEDIMENT, AND AMBIENT AIR TO IDENTIFY AND DEFINE ADDITIONAL AREAS OF THE SITE THAT CONSTITUTE A THREAT TO HUMAN HEALTH AND THE ENVIRONMENT. LONG-TERM MONITORING OF THE GROUNDWATER, SPRINGS, SURFACE WATER, SEDIMENT, AND ECOLOGY WILL BE IMPLEMENTED TO IDENTIFY ANY SITE-RELATED IMPACTS.

#SSC

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 SITE GEOLOGY AND HYDROGEOLOGY

THE LOCAL GEOLOGY IN THE AREA OF THE TRI-CITY SITE IS DOMINATED BY SEDIMENTARY ROCKS OF MISSISSIPIAN AGE. THESE INCLUDE, IN STRATIGRAPHIC ORDER (TOP TO BOTTOM), THE SALEM LIMESTONE, THE HARRODSBURG LIMESTONE, AND MEMBERS OF THE BORDEN FORMATION (THE MULDRAUGH MEMBER, THE HOLTSCLAW SILTSTONE MEMBER, AND THE NANCY MEMBER). THE STRATIGRAPHY OF THE AREA IS SHOWN IN FIGURE 2.

THE SALEM LIMESTONE IS DESCRIBED AS INTERBEDDED LIMESTONE AND SHALE WHICH FORMS THE CAPROCK ON MOST OF THE HILLS IN THE KNOB REGION WEST OF SUN RISE RIDGE. FORMATION THICKNESS IN THE VICINITY OF THE SITE RANGES FROM 18 TO 25 FEET BASED ON THE GEOLOGIC MAP. THE CONTACT OF THE SALEM LIMESTONE WITH THE UNDERLYING HARRODSBURG LIMESTONE IS GENERALLY DISTINCT AND WEATHERS TO A SILICIFIED BED OF GRANULAR FOSSIL-FRAGMENTED LIMESTONE.

THE HARRODSBURG LIMESTONE FORMS THE CAPROCK ON MOST OF THE RIDGES AND CONSISTS OF LIGHT GRAY TO YELLOWISH GRAY FOSSIL-FRAGMENTED LIMESTONE WEATHERING TO A REDDISH, CHERTY CLAY SOIL. THE CONTACT OF THE HARRODSBURG LIMESTONE WITH THE UNDERLYING MULDRAUGH MEMBER OF THE BORDEN FORMATION IS A CLEARLY MARKED LITHOLOGIC CHANGE AND IS POSSIBLY UNCONFORMABLE.

THE SURFICIAL, THIN LIMESTONE AQUIFER IS COMPOSED OF THE SALEM LIMESTONE AND THE HARRODSBURG LIMESTONE. THIS AQUIFER IS UNCONFINED AND IT VARIES FROM 10 TO 50 FEET IN THICKNESS. THE GROUNDWATER MOVES ALONG PREFERENTIAL FLOW PATHWAYS WITHIN THE IRREGULAR CONTACT BETWEEN THE PARTIALLY DECOMPOSED AND COMPLETELY DECOMPOSED ROCK (THE OVERBURDEN), THIN FRACTURES, AND SOLUTION CHANNELS ALONG BEDDING PLANES. SPRINGS AND SEEPS SPORADICALLY OCCUR WHERE THE GEOLOGIC UNITS THAT COMPRISE THE AQUIFER ARE EXPOSED AND MARK THE DISCHARGE POINTS FOR THE PREFERENTIAL FLOW PATHWAYS.

THE MULDRAUGH MEMBER IS THE UPPER UNIT OF THE BORDEN FORMATION AND IT CONSISTS OF DOLOMITIC SILTSTONE, SILTY DOLOMITE, AND LIMESTONE. QUARTZ GEODES ARE COMMON IN THE DOLOMITIC SILTSTONE AND ARE A DISTINGUISHING FEATURE OF THE UPPER MULDRAUGH. A DISTINCTIVE GLAUCONITE SEAM OVERLIES THE LIMESTONE AND IS PRESENT IN AREAS WHERE THE LIMESTONE IS ABSENT. AS A RESULT, THE GLAUCONITE SEAM IS MAPPED AS THE BASE OF THE MULDRAUGH MEMBER.

THE HOLTSCLAW SILTSTONE MEMBER UNDERLIES THE MULDRAUGH MEMBER AND IT IS COMPOSED OF SILTSTONE AND SILTY SHALE. THE SILTSTONE IN THE HOLTSCLAW MEMBER CONTAINS IRON-STAINED, MEDIUM GRAY, CALCAREOUS CONCRETIONS. LOCALLY, THE HOLTSCLAW MEMBER HAS A SILTY SHALE NEAR THE TOP OF THE UNIT WHICH IS SIMILAR TO THE UNDERLYING NANCY MEMBER. THE CONTACT BETWEEN THE HOLTSCLAW MEMBER AND THE NANCY MEMBER IS GRADATIONAL WITH INTERBEDDING OVER AN INTERVAL AS GREAT AS 40 FEET. THE NANCY MEMBER IS COMPOSED OF SILTY SHALE AND IT IS STRATIGRAPHICALLY EQUIVALENT TO THE HOLTSCLAW MEMBER IN THE AREA OF THE SITE.

GROUNDWATER FLOWS THROUGH INTERCONNECTED FRACTURES, BEDDING PLANES, AND DISSOLUTION PATHWAYS IN THE VARIOUS MEMBERS OF THE BORDEN FORMATION. THE EXTENT OF HYDRAULIC CONNECTION, IF ANY, BETWEEN THE MEMBERS IS NOT KNOWN. THE SILTSTONE AND LIMESTONE UNITS OF THESE MEMBERS PRODUCE SUFFICIENT WATER SUPPLIES FOR DOMESTIC USE. HOWEVER, SPRINGS ARE USED AS WATER SUPPLY SOURCES MORE FREQUENTLY THAN DRILLED WELLS DUE TO THE SPORADIC AND UNPREDICTABLE OCCURRENCE OF WATER IN THE MEMBERS.

THE DATA FOR THE TRI-CITY SITE INDICATES THAT MOST OF THE RECHARGE TO THE AQUIFERS OCCURS ON THE NORTH SIDE OF BEGHTOL RIDGE. MOVEMENT OF GROUNDWATER IS BELIEVED TO BE TO THE SOUTH-SOUTHWEST, MOVING DOWN-DIP ALONG BEDDING PLANES AND FOLLOWING AVAILABLE PERMEABLE PATHWAYS. GROUNDWATER DISCHARGES VIA SPRINGS AND SEEPS WHICH ARE PREDOMINANTLY LOCATED ON THE SOUTH AND WEST SIDES OF BEGHTOL RIDGE.

WITH THE EXCEPTION OF BEDROCK OUTCROP OCCURRENCES ALONG DISSECTING STREAMS, AND AT A LIMITED NUMBER OF OTHER LOCATIONS, SURFACE DEPOSITS AT THE SITE CONSISTS OF SOILS DERIVED FROM THE WEATHERING OF THE SALEM LIMESTONE AND HARRODSBURG LIMESTONE, OR AN ARTIFICIAL FILL COMPRISED OF DISPOSAL DEBRIS AND LOCALLY DERIVED COVER. BASED ON DRILLING AND SOIL BORING LOGS, THE UNCONSOLIDATED ZONE RANGES FROM 8.5 TO 27 FEET OVER THE SITE WITH THINNER OVERBURDEN DEPOSITS IN THE NORTHEAST CORNER OF THE SITE AND ALONG THE STEEP HILLSIDES. THE AVERAGE DEPTH TO BEDROCK IS APPROXIMATELY 18 FEET AND MAXIMUM DEPTHS TO BEDROCK WERE IN BORINGS AT THE BASE OF THE HILLSIDES.

RECHARGE TO THE AQUIFERS OCCURS EITHER BY INFILTRATION OF PRECIPITATION INTO THE OVERBURDEN OR BY INFILTRATION OF THE RUNOFF DIRECTLY INTO THE AQUIFERS. INFILTRATION THROUGH THE OVERBURDEN TO THE PARTIALLY DECOMPOSED ROCK OF THE SALEM LIMESTONE/HARRODSBURG LIMESTONE AQUIFER IS PROBABLY LIMITED BY THE LOW PERMEABILITY AND THE THICKNESS. INFILTRATION IS PROBABLY GREATER IN THE NORTHERN PART OF THE SITE (NEAR THE COX, JR. AND HOOSIER RESIDENCES) WHERE THE OVERBURDEN IS APPROXIMATELY 5 FEET THICK DUE TO PAST EARTHMOVING OPERATIONS, THAN IN THE SOUTHERN PART OF THE SITE. THE LOW PERMEABILITY AND GREATER THICKNESS OF THE OVERBURDEN ALSO EXPLAINS WHY THE PONDS EXCAVATED IN THE SOUTHERN PART OF THE SITE USUALLY CONTAIN WATER DURING PERIODS WHEN SPRINGS AND SEEPS GO DRY.

SOME HYDRAULIC COMMUNICATION BETWEEN THE DIFFERENT AQUIFERS AT THE SITE HAS BEEN APPARENT. HYDRAULIC COMMUNICATION BETWEEN THE OVERBURDEN AND THE SALEM LIMESTONE/HARRODSBURG LIMESTONE AQUIFER IS EVIDENT BASED ON THE SPRINGS AND DRILLING. SPRINGS DISCHARGING FROM THE HARRODSBURG LIMESTONE HAVE BEEN IMPACTED BY CONTAMINANTS BURIED IN AND/OR POURED ONTO THE OVERBURDEN. WATER OR CONTAMINANTS PERCOLATING THROUGH THE OVERBURDEN OR WASTES DISPOSED ON-SITE, OR WATER INFILTRATING ALONG THE BASE OF THE OVERBURDEN, COULD ENTER THE SALEM LIMESTONE/HARRODSBURG LIMESTONE AQUIFER AT THE CONTACT BETWEEN THE OVERBURDEN AND THE PARTIALLY WEATHERED ROCK TO CONTAMINATE THE AQUIFER.

INSUFFICIENT DATA EXISTS TO DETERMINE WHETHER THE SALEM LIMESTONE/HARRODSBURG LIMESTONE AQUIFER AND THE MULDRAUGH MEMBER OF THE BORDEN FORMATION ARE HYDRAULICALLY CONNECTED. THE CONTACT BETWEEN THE TWO AQUIFERS IS MARKED BY SOLUTIONING IN THE HARRODSBURG LIMESTONE, WHICH INDICATES THAT THE MULDRAUGH MEMBER IS MORE RESISTANT. HOWEVER, THE EXTENT OF JOINTING OR FRACTURING IN THE MULDRAUGH MEMBER OR AT THE CONTACT IS NOT KNOWN.

5.2 NATURE OF CONTAMINATION

THE PRIMARY WASTES OF CONCERN HAVE BEEN THE DRUMMED AND BULK LIQUIDS DISPOSED OF AT THE SITE. THE CABINET'S INVESTIGATION IN APRIL 1987 INCLUDED THE COLLECTION OF TWO WASTE SAMPLES FROM DETERIORATED DRUMS PROTRUDING THROUGH THE SURFACE SOIL IN THE RAVINE ON THE EASTERN SIDE OF THE SITE. THESE TWO SAMPLES, ALTHOUGH LOCATED NEAR EACH OTHER, HAD SIGNIFICANT DIFFERENCES IN COMPOSITION. SAMPLE TCD-08 CONTAINED MUCH GREATER CONCENTRATIONS OF ORGANIC CONTAMINANTS, WITH PHENOL, 4-METHYLPHENOL, AND 2,4-DIMETHYLPHENOL AT 2860 PPM, 7813 PPM, AND 1553 PPM, RESPECTIVELY. SAMPLE TCD-08A CONTAINED PHENOL AND 4-METHYLPHENOL AT CONCENTRATIONS LESS THAN 13 PPM. SAMPLE TCD-08A HAD SIGNIFICANTLY HIGHER CONCENTRATIONS OF INORGANIC CONTAMINANTS, EXHIBITING ARSENIC, CHROMIUM, LEAD, AND MERCURY AT 3.2 PPM, 49.3 PPM, 33.7 PPM, AND 7.44 PPM, RESPECTIVELY. EACH OF THESE CONTAMINANTS WAS DETECTED IN SAMPLE TCD-08, BUT IN CONCENTRATIONS THAT RANGED FROM 4.45 PPM TO 0.024 PPM. FIGURE 10 SHOWS THE SAMPLING LOCATIONS DURING THE CABINET'S INVESTIGATION.

DURING THE ADDITIONAL STUDY CONDUCTED BY EPA IN MAY 1988 THREE WASTE SAMPLES WERE COLLECTED FROM PARTIALLY EXPOSED DRUMS ALONG THE EASTERN AND SOUTHERN BOUNDARIES OF THE FORMER DISPOSAL AREA. THE SAMPLE LOCATIONS ARE SHOWN IN FIGURE 11. THE INORGANIC ANALYSES OF THESE SAMPLES REVEALED A NUMBER OF CONTAMINANTS, INCLUDING CHROMIUM, COPPER, LEAD, MERCURY, ZINC, AND CYANIDE, WHICH WERE COMMON TO ALL THREE SAMPLES. OF THESE CONTAMINANTS, LEAD WAS THE MOST PREDOMINANT CONTAMINANT WITH CONCENTRATIONS OF 78 PPM TO 390 PPM IN THE THREE SAMPLES. ORGANIC ANALYSES WERE NOT CONDUCTED.

WASTE SAMPLES WERE ALSO COLLECTED BY EPA DURING THE EMERGENCY REMOVAL ACTION CONDUCTED IN AUGUST AND SEPTEMBER 1988. THE HAZARDOUS MATERIALS INDENTIFIED DURING THE REMOVAL INCLUDED PCE, TOLUENE, ETHYL BENZENE, XYLENE, POLYCHLORINATED BIPHENYLS (PCBS), AND LEAD.

5.3 EXTENT OF CONTAMINATION

PREVIOUS INVESTIGATIONS AT THE TRI-CITY SITE HAVE INCLUDED SAMPLING OF GROUNDWATER, SOILS, SURFACE WATER, SEDIMENTS, AND AMBIENT AIR. THE FINDINGS, BY MEDIUM, ARE DISCUSSED BELOW.

5.3.1 GROUNDWATER

GROUNDWATER, AS IT DISCHARGES TO THE SURFACE AS SPRINGS, HAS BEEN THE PREDOMINANT MEDIUM OF CONCERN AT THE SITE BECAUSE OF ITS USE AS A SOURCE OF POTABLE WATER. GROUNDWATER HAS BEEN SAMPLED IN FIVE SEPARATE EVENTS, ONE CONDUCTED BY KENTUCKY AND FOUR BY EPA. THE KENTUCKY INVESTIGATION IN APRIL 1987 INCLUDED FOUR GROUNDWATER SAMPLES, ONE EACH FROM BRADING SPRING #1, BRADING SPRING #2, THE KLAPPER SPRING, AND THE UNNAMED SPRING ON THE SOUTHEASTERN SLOPE OF THE FORMER DISPOSAL AREA. ALL OF THE SPRINGS, EXCEPT FOR THE UNNAMED SPRING, HAVE BEEN USED AS SOURCES OF POTABLE WATER. BRADING SPRING #1 IS TOPOGRAPHICALLY SEPARATED FROM THE SITE AND IS CONSIDERED REPRESENTATIVE OF BACKGROUND CONDITIONS. FIGURE 10 SHOWS THE SAMPLING LOCATIONS DURING THE CABINET'S INVESTIGATION.

THE KENTUCKY INVESTIGATION REVEALED ORGANIC CONTAMINATION ABOVE BACKGROUND LEVELS IN THE KLAPPER SPRING AND THE UNNAMED SPRING. HOWEVER, ONLY THE LEVELS OF TETRACHLOROETHENE (PCE) EXCEEDED MAXIMUM CONTAMINANT LEVELS (MCLS). METALS LEVELS DID NOT EXCEED MCLS. THE ANALYTICAL RESULTS ARE SUMMARIZED IN TABLE 1. CURRENT AND PROPOSED MCLS AND MCLGS THAT ARE PERTINENT TO THE SITE

ARE LISTED IN TABLE 2.

EPA CONDUCTED FURTHER SAMPLING OF THE KLAPPER SPRING IN MAY 1988. THE RESULTS SHOWED PCE AT 133 PPB IN THE SPRING SAMPLE AND 50 PPB IN THE TAP SAMPLE, LEVELS WHICH AGAIN EXCEEDED MCLS. RESULTS OF A SCREENING OF POTABLE WATER SOURCES CONDUCTED BY EPA IN MAY 1988 AGAIN INDICATED THE PRESENCE OF PCE IN THE KLAPPER SPRING. IN ADDITION, PCE WAS DETECTED IN THE COX SPRING. CONCURRENT SAMPLING DONE BY THE CABINET AND ALSO ANALYZED IN THE STATE'S LABORATORY REVEALED LEVELS OF PCE ABOVE MCLS IN THE TAP AND SPRING SAMPLES FROM THE COX, SR. AND KLAPPER RESIDENCES. THIS ANALYSIS ALSO SHOWED LEVELS OF TCE ABOVE MCLS IN THE SPRING AND TAP SAMPLES COLLECTED FROM THE COX, SR. RESIDENCE.

EPA COLLECTED FOUR GROUNDWATER SAMPLES IN LATE MAY 1988 AS PART OF AN ADDITIONAL STUDY TO DETERMINE THE IMPACT OF THE SITE. THESE SAMPLES WERE COLLECTED FROM THE KLAPPER SPRING, THE COX SPRING, THE CATTLE SPRING, AND A PRIVATE WELL NEAR THE BEGHTOL RESIDENCE. THE SAMPLE LOCATIONS ARE SHOWN IN FIGURE 11. THE MOST SIGNIFICANT FINDINGS WERE THE ANALYTICAL RESULTS FROM THE COX SPRING SAMPLE. FOUR VOLATILE ORGANIC COMPOUNDS, INCLUDING PCE AND TCE, WERE FOUND AT LEVELS THAT EXCEEDED MCLS. PCE WAS AGAIN FOUND IN THE KLAPPER SPRING AT AN ESTIMATED VALUE THAT EXCEEDED MCLS. ONE PHTHALATE WAS FOUND IN THE CATTLE SPRING AT A LEVEL HIGHER THAN THE MCL. NO CONTAMINATION WAS FOUND IN THE WELL SAMPLE. THE RESULTS OF THE ORGANIC ANALYSES ARE SUMMARIZED IN TABLE 3. METALS LEVELS IN THE SPRING SAMPLES DID NOT EXCEED MCLS. THE RESULTS OF THE INORGANIC ANALYSES ARE SUMMARIZED IN TABLE 4.

SAMPLES FROM FOUR SPRINGS WERE COLLECTED IN JULY 1989 BY EPA'S CONTRACTOR, EBASCO SERVICES, DURING THE REMEDIAL INVESTIGATION. A TOTAL OF FIVE SAMPLES, INCLUDING ONE DUPLICATE FROM THE COX SPRING, WERE COLLECTED FROM THE COX SPRING, THE KLAPPER SPRING, THE CATTLE SPRING, AND BRADING SPRING NO. 2. THE SAMPLING LOCATIONS ARE SHOWN IN FIGURE 12. ONLY THE SAMPLES FROM THE COX SPRING SHOWED VOLATILE ORGANIC CONTAMINATION, WITH THE LEVELS OF FOUR COMPOUNDS EXCEEDING MCLS. NO SEMIVOLATILE ORGANICS OR PESTICIDES WERE FOUND IN THE SPRING SAMPLES. A SUMMARY OF THE ORGANIC ANALYSES OF THE SPRING SAMPLES IS SHOWN IN TABLE 5. METALS LEVELS IN THE SPRING SAMPLES DID NOT EXCEED MCLS. THE RESULTS OF THE INORGANIC ANALYSES ARE SUMMARIZED IN TABLE 6.

DURING PHASE II OF THE RI, THE INSTALLATION OF THIRTEEN MONITORING WELLS WAS ATTEMPTED. HOWEVER, ONLY SIX WELLS PROVIDED SUFFICIENT WATER FOR COMPLETION. THE ATTEMPTED AND COMPLETED GROUNDWATER MONITORING WELL LOCATIONS ARE SHOWN IN FIGURE 13. THE WELL MW-02 IS SCREENED IN THE HARRODSBURG LIMESTONE FORMATION AND THE MULDRAUGH MEMBER OF THE BORDEN FORMATION. MW-04 AND MW-08 ARE SCREENED IN THE MULDRAUGH FORMATION, AND MW-05 IS SCREENED IN THE SALEM LIMESTONE FORMATION. MW-11 AND MW-12 ARE SCREENED IN THE NANCY MEMBER OF THE BORDEN FORMATION.

PCE WAS DETECTED IN MONITORING WELL MW-04 AT 10 PPB, A LEVEL WHICH IS TWICE THE MCL. ESTIMATED QUANTITIES OF TOTAL XYLENES WERE FOUND IN TWO SAMPLES COLLECTED FROM MONITORING WELL MW-08, BUT THE LEVELS WERE WELL BELOW THE MCL. NO PESTICIDES OR SEMIVOLATILE ORGANIC COMPOUNDS WERE FOUND IN THE MONITORING WELL SAMPLES.

CADMIUM WAS DETECTED IN THE SAMPLE FROM MW-12 AT A LEVEL SLIGHTLY ABOVE THE MCL. LEAD WAS DETECTED IN FIVE WELL SAMPLES FROM TWO DIFFERENT WATER FORMATIONS AT LEVELS THAT RANGED FROM 5 TO 32 PPB. LEAD WAS NOT DETECTED IN THE FORMATIONS IMMEDIATELY UNDERLYING THE SITE. NICKEL WAS FOUND IN FIVE WELL SAMPLES FROM THREE WATER FORMATIONS AT LEVELS THAT RANGED FROM 100 TO 170 PPB. BOTH METALS OCCUR NATURALLY IN THE AREA OF THE SITE, WHICH IS A SEDIMENTARY ENVIRONMENT DOMINATED BY LIMESTONES, SHALES, AND SILTSTONES. THE RESULTS OF THE INORGANIC ANALYSES OF THE SAMPLES FROM THE GROUNDWATER MONITORING WELLS ARE SUMMARIZED IN TABLE 7.

EPA'S ENVIRONMENTAL SERVICES DIVISION CONDUCTED ADDITIONAL SAMPLING OF THE COX, KLAPPER, AND CATTLE SPRINGS, AND THE MONITORING WELL MW-12 IN DECEMBER 1990. TWO VOLATILE ORGANIC COMPOUNDS, PCE AND TCE, WERE DETECTED AT ESTIMATED LEVELS IN THE COX SPRING SAMPLE THAT WERE ABOVE THE

MCLS. AN ESTIMATED LEVEL OF PCE WAS DETECTED IN THE KLAPPER SPRING SAMPLE AND AN ESTIMATED LEVEL OF TOLUENE WAS FOUND IN THE CATTLE SPRING SAMPLE, BUT BOTH LEVELS WERE BELOW MCLS. NO VOLATILE ORGANIC CONTAMINANTS WERE DETECTED IN THE SAMPLE FROM MW-12. THE RESULTS OF THE VOLATILE ORGANIC ANALYSES ARE SUMMARIZED IN TABLE 8.

THE METALS DETECTED IN THE SPRING SAMPLES WERE COMMON TO A SEDIMENTARY ENVIRONMENT. THE LEVELS OF METALS DETECTED IN THE SPRING SAMPLES AND THE SAMPLE FROM MW-12 DID NOT EXCEED MCLS. AND THOUGH THE MINIMUM QUANTITATION LIMITS FOR LEAD AND THALLIUM WERE HIGHER THAN THE PROPOSED MCLS, THESE METALS WERE NOT DETECTED DURING THE RI WHEN MORE SENSITIVE ANALYTICAL METHODS WERE USED (SEE THE ANALYTICAL DATA IN TABLES 6 AND 7). THE RESULTS OF THE INORGANIC ANALYSES OF THE SAMPLES COLLECTED IN DECEMBER 1990 ARE SUMMARIZED IN TABLE 9.

5.3.2 SOILS

SITE SOILS WERE ALSO INVESTIGATED DURING FIVE SEPARATE EVENTS, ONE CONDUCTED BY KENTUCKY AND FOUR BY EPA. THE KENTUCKY INVESTIGATION IN APRIL 1987 INCLUDED THREE SOIL SAMPLES, ONE BACKGROUND (TCD-02) AND TWO SAMPLES (TCD-06 AND TCD-07) OBTAINED FROM THE AREA AROUND THE WASTE SAMPLE LOCATIONS. FIGURE 10 SHOWS THE SOIL SAMPLE LOCATIONS. THE BACKGROUND SAMPLE WAS COLLECTED FROM A DEPTH OF 4 INCHES, WHILE TCD-06 WAS TAKEN DIRECTLY FROM THE SURFACE AND TCD-07 WAS COMPOSITED FROM THE SURFACE TO A DEPTH OF 4 FEET.

FEW ORGANIC CONTAMINANTS WERE DETECTED IN THE SOIL SAMPLES. THE GREATEST CONCENTRATION OBSERVED WAS 2.8 PPM OF METHYLPHENOL FOUND IN TCD-06. THIS COMPOUND WAS NOT DETECTED IN THE BACKGROUND SAMPLE. IN ADDITION, TCD-06 CONTAINED TWO SPECIES OF PCBS, AROCLOR 1254 AND AROCLOR 1260, AT CONCENTRATIONS LESS THAN 0.30 PPM. THESE COMPOUNDS WERE BELOW DETECTABLE LIMITS IN THE OTHER SOIL SAMPLES AND ALSO ABSENT FROM THE WASTE SAMPLES. FOR THE MAJORITY OF INORGANIC CONTAMINANTS DETECTED, ONSITE CONCENTRATIONS VARIED LITTLE FROM BACKGROUND CONDITIONS. THE CONTAMINANTS DEMONSTRATING SIGNIFICANT CONCENTRATIONS ABOVE BACKGROUND WERE CADMIUM AND MERCURY.

DURING THE ADDITIONAL STUDY CONDUCTED BY EPA IN MAY 1988 FIVE COMPOSITE SURFACE SOIL SAMPLES WERE COLLECTED FROM SENSITIVE AREAS, INCLUDING TWO FROM GARDENS, TWO FROM YARDS, AND ONE FROM THE SOUTHEASTERN SLOPE OF THE LANDFILL. THE SAMPLE LOCATIONS WERE SHOWN IN FIGURE 11.

THE RESULTS OF THE INORGANIC ANALYSES SHOWED THAT THE SURFACE SOIL SAMPLE TC-G-CS CONTAINED A NUMBER OF METALS. THE METALS PRESENT IN HIGHEST CONCENTRATIONS WERE COPPER, LEAD, AND ZINC AT 430 PPM, 210 PPM, AND 870 PPM, RESPECTIVELY. THESE METALS WERE ALSO PRESENT IN THE SAMPLES COLLECTED FROM THE YARDS (TC-F-CS AND TC-D-CS) AND THE GARDENS (TC-B-CS AND TC-E-CS), BUT IN SUBSTANTIALLY LOWER CONCENTRATIONS.

CYANIDE WAS DETECTED IN ALL SAMPLES, BUT TC-G-CS AND TC-D-CS CONTAINED THE HIGHEST LEVELS: 4.8 PPM AND 5.4 PPM, RESPECTIVELY. OTHER INORGANIC CONTAMINANTS OF NOTE THAT WERE PRESENT IN TC-G-CS BUT ABSENT FROM THE YARD AND GARDEN SAMPLES WERE CADMIUM AND MERCURY AT 2.4 PPM AND 2.8 PPM, RESPECTIVELY.

ORGANIC ANALYSES OF THE SOIL SAMPLES REVEALED FEW POSITIVELY IDENTIFIED COMPOUNDS. BIS (2-ETHYLHEXYL) PHTHALATE AND AROCLOR-1254 WERE DETECTED IN THE SAMPLE TC-G-CS AT CONCENTRATIONS OF 3700 PPB AND 200 PPB, RESPECTIVELY. BOTH OF THESE COMPOUNDS WERE ABSENT FROM THE YARD AND GARDEN SAMPLES. A NUMBER OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHS) WERE ALSO DETECTED IN TC-G-CS IN ESTIMATED CONCENTRATIONS THAT RANGED FROM 89 TO 440 PPB. THESE COMPOUNDS WERE ABSENT FROM THE OTHER SOIL SAMPLES COLLECTED. TOLUENE WAS DETECTED AT A LEVEL OF 1000 PPB IN THE SAMPLE TC-B-CS, WHICH WAS COLLECTED FROM A GARDEN APPROXIMATELY 800 FEET FROM THE FORMER DISPOSAL AREA. THIS COMPOUND WAS ALSO OBSERVED IN TC-G-CS AND BOTH YARD SAMPLES AT ESTIMATED CONCENTRATIONS RANGING FROM 28 PPB TO 2900 PPB. SAMPLE TC-B-CS ALSO CONTAINED A NUMBER OF PESTICIDES, WITH DIELDRIN AND ENDOSULFAN APPEARING IN THE HIGHEST CONCENTRATIONS: 27 PPB AND 14

PPB, RESPECTIVELY. THESE COMPOUNDS WERE GENERALLY ABSENT FROM THE REMAINING SOIL SAMPLES, EXCEPT TC-E-CS WHICH CONTAINED 4,4'-DDT AT A LEVEL OF 7.6 PPB.

SUBSURFACE SOIL SAMPLES WERE COLLECTED DURING THE FIELD ANALYTICAL SCREENING PROCEDURES (FASP) CONDUCTED BY NUS CORPORATION IN AUGUST 1988 TO COMPLEMENT THE GEOPHYSICAL SURVEY. A TOTAL OF 24 SUBSURFACE SOIL SAMPLES WERE COLLECTED, INCLUDING ONE BACKGROUND SAMPLE. SAMPLE LOCATIONS ARE SHOWN IN FIGURE 14. THE RESULTS OF THE FIELD SCREENING INDICATED THE PRESENCE OF VOCS IN THE SUBSURFACE SOILS IN THREE SECTIONS OF THE LANDFILL: THE SOUTHWEST CORNER, THE SOUTHEAST CORNER, AND ALONG THE CENTRAL SECTION OF THE EASTERN BOUNDARY. OF THESE THREE AREAS, THE HIGHEST CONCENTRATIONS OF CONTAMINANTS WERE FOUND IN THE SOUTHWEST CORNER OF THE LANDFILL, WHICH CORRESPONDS WITH THE AREA IN WHICH THE EMERGENCY REMOVAL ACTION WAS SUBSEQUENTLY CONDUCTED. ELEVATED LEVELS OF 1,1-DICHLOROETHANE, TRICHLOROETHENE, TOLUENE, TETRACHLOROETHENE, ETHYL BENZENE, AND P-XYLENE WERE FOUND IN TWO SAMPLES FROM THIS AREA.

THE SOUTHEAST CORNER OF THE SITE WAS REPRESENTED BY SAMPLES TC-SS-12, 13, AND 14. EACH OF THESE SAMPLES CONTAINED ELEVATED LEVELS OF PCE. IN ADDITION, SAMPLES TC-SS-12 AND 14 CONTAINED 1,1-DICHLOROETHANE. VOCS WERE ALSO DETECTED IN SAMPLES TC-SS-20, 21, AND 23 ALONG THE EASTERN BOUNDARY OF THE LANDFILL.

SURFACE SOIL SAMPLES (0-6") WERE COLLECTED FROM TWENTY LOCATIONS DURING THE REMEDIAL INVESTIGATION, THIRTEEN OF THE DRILLING LOCATIONS AND SEVEN SELECTED SITE LOCATIONS. THE SAMPLING LOCATIONS ARE SHOWN IN FIGURE 15.

TOLUENE WAS DETECTED IN THE THREE SAMPLES TC-SS-07-1, 08-1, AND 16-1 AT LEVELS BETWEEN 30 PPB AND 87 PPB. TOLUENE WAS ALSO DETECTED IN THE SAMPLES TC-SS-19-1 AND 21-1 ON THE EASTERN EDGE OF THE FORMER DISPOSAL AREA AT ESTIMATED LEVELS OF 3 PPB AND 5 PPB, RESPECTIVELY. CHLOROFORM WAS DETECTED IN ONE SAMPLE, TC-SS-11-1, NEAR BRUSHY FORK CREEK AT AN ESTIMATED LEVEL OF 3 PPB.

FOUR SPECIES OF PAHS WERE DETECTED AT ESTIMATED LEVELS RANGING FROM 61 TO 140 PPB IN ONE SURFACE SOIL SAMPLE, TC-SS-21-1, ON THE EASTERN EDGE OF THE LANDFILL. THIS SAMPLE ALSO CONTAINED 490 PPB OF AROCLOR 1260, WHICH IS BELOW EPA'S CLEAN-UP LEVEL OF 0.5 TO 1 PPM TO ACHIEVE A E-6 CANCER RISK LEVEL. ONE PHTHALATE WAS DETECTED AT AN ESTIMATED LEVEL OF 120 PPB IN THE DUPLICATE OF TC-SS-03-1 ON THE SOUTHEASTERN EDGE OF THE DISPOSAL AREA.

THE MAJORITY OF THE METALS LEVELS IN THE SURFACE SOIL SAMPLES WERE COMPARABLE TO THE LEVELS IN THE BACKGROUND SAMPLE TC-SS-01 AND WERE TYPICAL OF A SEDIMENTARY ENVIRONMENT CHARACTERIZED BY LIMESTONES, SHALES, AND SILTSTONES. THE ANALYTICAL RESULTS ARE SUMMARIZED IN TABLE 10 AS DATA RANGES FOR EACH CONTAMINANT.

A TOTAL OF 27 SUBSURFACE SOIL SAMPLES WERE COLLECTED FROM 25 LOCATIONS CORRESPONDING WITH THE MONITORING WELLS THAT WERE ATTEMPTED AND COMPLETED DURING THE REMEDIAL INVESTIGATION. SAMPLE LOCATIONS ARE SHOWN IN FIGURE 13. SAMPLE DEPTHS VARIED FROM TWO TO SEVENTEEN FEET.

VOLATILE ORGANIC COMPOUNDS (VOCS) WERE FOUND IN THREE SUBSURFACE SOIL SAMPLES. AN ESTIMATED LEVEL OF 5 PPB PCE WAS FOUND IN THE SOIL BORING CLOSEST TO THE SOUTHERNMOST DISPOSAL TRENCH, TC-SB-03, AT A DEPTH OF 5 TO 7 FEET, AND THE DUPLICATE CONTAINED AN ESTIMATED 3 PPM EACH OF PCE AND TOLUENE. FIFTEEN DIFFERENT PAH COMPOUNDS AND DIBENZOFURAN WERE ALSO FOUND AT THIS SAMPLE LOCATION IN THE INTERVAL FROM 11 TO 13 FEET. FOUR SPECIES OF PAHS WERE FOUND IN THE SAMPLE COLLECTED FROM 5 TO 7 FEET, AND ITS DUPLICATE CONTAINED THREE PAHS AND TWO PHTHALATES. ONE PHTHALATE WAS FOUND IN TC-SB-01 AT 10 TO 12 FEET AND ACETONE WAS FOUND IN TC-SB-02 AT 2 TO 4 FEET.

THE METALS LEVELS IN THE SUBSURFACE SOIL SAMPLES WERE COMPARABLE TO THE LEVELS FOUND IN THE SURFACE SOIL SAMPLES. THE ANALYTICAL RESULTS ARE SUMMARIZED IN TABLE 10 AS RANGES OF DATA FOR

EACH CONTAMINANT.

THREE SURFACE SOIL SAMPLES (0-3") IN THE VICINITY OF THE MONITORING WELL MW-12 WERE COLLECTED BY EPA DURING THE DECEMBER 1990 INVESTIGATION. THESE SAMPLE LOCATIONS ARE SUFFICIENTLY REMOVED FROM THE DISPOSAL AREAS AT THE TRI-CITY SITE TO BE INDICATIVE OF BACKGROUND CONDITIONS. ANALYTICAL RESULTS INDICATED THAT THE CONCENTRATIONS OF METALS IN THE SOIL SAMPLES WERE COMMON TO A SEDIMENTARY ENVIRONMENT DOMINATED BY LIMESTONES, SHALES, AND SILTSTONES. LOW CONCENTRATIONS OF MERCURY WERE DETECTED IN EACH SOIL SAMPLE, BUT MERCURY IS FOUND IN SEDIMENTARY ENVIRONMENTS AND IS OFTEN ASSOCIATED WITH CARBONACEOUS MATERIALS SUCH AS LIMESTONES AND SHALES. MERCURY WAS NOT DETECTED IN ANY OF THE SOIL SAMPLES COLLECTED DURING THE RI. THE RESULTS OF THE METALS ANALYSES FROM THE DECEMBER 1990 SAMPLING EVENT ARE SUMMARIZED IN TABLE 11 AS RANGES OF DATA FOR EACH CONTAMINANT. NO PURGEABLE ORGANIC COMPOUNDS WERE FOUND IN THE SAMPLES.

5.3.3 SURFACE WATER

THE SURFACE WATER WAS INVESTIGATED IN JULY 1989 DURING THE RI. A TOTAL OF SEVEN SURFACE WATER SAMPLES, INCLUDING A DUPLICATE OF SW-06, WERE COLLECTED AT THE LOCATIONS SHOWN IN FIGURE 16. FOUR SAMPLES WERE COLLECTED FROM BRUSHY FORK CREEK (ONE UPSTREAM, TWO DIRECTLY SOUTH OF THE SITE, AND ONE DOWNSTREAM), AND ONE SAMPLE EACH WAS COLLECTED FROM THE TWO UNNAMED INTERMITTENT STREAMS DISCHARGING TO BRUSHY FORK CREEK. CHLOROFORM WAS DETECTED IN THE DUPLICATE OF SW-06 AT AN ESTIMATED LEVEL OF 2 PPB. TCE WAS DETECTED IN SW-02 AT AN ESTIMATED LEVEL OF 1 PPB. AND, TOLUENE WAS DETECTED IN SW-04 AT AN ESTIMATED LEVEL OF 4 PPB.

BARIUM AND POTASSIUM WERE DETECTED IN ALL OF THE SURFACE WATER SAMPLES, EXCEPT THE UPGRADIENT SAMPLE. NICKEL AND ALUMINUM WERE FOUND ONLY IN SW-05, WHICH WAS COLLECTED FROM AN INTERMITTENT CREEK ENTERING BRUSHY FORK CREEK ON THE SIDE OPPOSITE FROM THE SITE. MANGANESE WAS DETECTED IN SW-05 AND IN THE UPGRADIENT SAMPLE. THE OTHER METALS LEVELS WERE COMPARABLE ACROSS ALL SAMPLES. THE ANALYTICAL RESULTS FROM THE METALS ANALYSES ARE SUMMARIZED IN TABLE 12.

5.3.4 SEDIMENTS

TWO SEDIMENT SAMPLES WERE COLLECTED BY THE CABINET DURING THE APRIL 1987 INVESTIGATION, ONE BACKGROUND SAMPLE CORRESPONDING TO THE WATER SAMPLE FROM BRADING SPRING NO. 1 AND ONE SAMPLE CORRESPONDING TO THE WATER SAMPLE FROM THE UNNAMED SPRING ON THE SOUTHEASTERN SLOPE OF THE FORMER DISPOSAL AREA. THE UNNAMED SPRING SEDIMENT SAMPLE HAD GREATER CONCENTRATIONS OF THE INORGANIC COMPOUNDS DETECTED (I.E., ARSENIC, BARIUM, CADMIUM, CHROMIUM, LEAD, MERCURY, AND SILVER) THAN THE BACKGROUND SAMPLE. THE CONCENTRATION OF THE ORGANIC CONTAMINANT, CIS-1,3-DICHLOROPROPENE, FOUND IN THE UNNAMED SPRING SEDIMENT SAMPLE WAS JUST SLIGHTLY ELEVATED ABOVE THE BACKGROUND LEVEL.

A TOTAL OF ELEVEN SEDIMENT SAMPLES WERE COLLECTED CONCURRENTLY WITH THE SURFACE WATER SAMPLES IN JULY 1989 DURING THE REMEDIAL INVESTIGATION. FOUR OF THE SEDIMENT SAMPLES WERE COLLECTED FROM BRUSHY FORK CREEK AT THE SURFACE WATER SAMPLING LOCATIONS, TWO WERE COLLECTED FROM THE INTERMITTENT STREAMS FLOWING INTO BRUSHY FORK CREEK AT THE SURFACE WATER SAMPLING LOCATIONS, AND FIVE WERE COLLECTED FROM THE DEVELOPED DRAINAGE PATHS OF THE SPRINGS ORIGINATING FROM THE SITE. THE SEDIMENT SAMPLING LOCATIONS ARE SHOWN IN FIGURE 16.

SEVERAL VOCS WERE FOUND IN THE SEDIMENT SAMPLE SD-07 COLLECTED FROM THE DRAINAGE PATHWAY OF THE COX SPRING. TOLUENE, ACETONE, AND METHYL ETHYL KETONE WERE DETECTED AT 15 PPB, 110 PPB, AND 170 PPB, RESPECTIVELY, IN SD-07. ONE PHENOL WAS DETECTED AT ESTIMATED LEVELS OF 430 PPB AND 250 PPB IN THE SEDIMENT SAMPLE SD-11, AND ITS DUPLICATE SD-12, COLLECTED FROM BRUSHY FORK CREEK BELOW THE CONFLUENCE WITH THE COX SPRING DRAINAGE PATHWAY.

THE LEVELS OF THE METALS FOUND IN THE SEDIMENT SAMPLES WERE COMPARABLE TO THE LEVELS IN THE

UPGRADIENT SAMPLE, EXCEPT FOR THE SAMPLE TAKEN FROM THE DRAINAGE PATHWAY OF THE UNNAMED SPRING SD-06. THAT SAMPLE CONTAINED THE HIGHEST LEVELS OF MOST OF THE METALS, INCLUDING LEAD AND CHROMIUM. THE RESULTS OF THE METALS ANALYSES ARE SUMMARIZED IN TABLE 13.

5.3.5 AIR

AIR MONITORING AT THE TRI-CITY SITE WAS CONDUCTED DURING THE REMEDIAL INVESTIGATION. MONITORING INCLUDED THE COLLECTION OF AMBIENT AIR SAMPLES AND REAL-TIME AIR MONITORING USING DIRECT READING INSTRUMENTS DURING THE PHASE II DRILLING ACTIVITIES. THREE SAMPLING LOCATIONS WERE SELECTED BASED ON THE LOCATIONS OF THE RESIDENCES RELATIVE TO THE LANDFILL AREAS, THE PREVAILING WIND DIRECTIONS AT THE TIME OF THE AIR SAMPLE COLLECTION, AND SITE OPERATIONS. AMBIENT 8-HOUR AIR SAMPLES WERE TAKEN AT THE SAMPLING STATIONS PRIOR TO DISTURBANCE OF THE SOIL SO THAT PRE-WORK SITE CONDITIONS COULD BE DOCUMENTED. SUBSEQUENT SAMPLES WERE OBTAINED AT THE STATIONS ONCE A WEEK DURING DRILLING ACTIVITIES, RESULTING IN A TOTAL OF FOUR SAMPLES AT EACH LOCATION. DUPLICATE SAMPLES WERE TAKEN AT THE LOCATION NEXT TO THE COX, JR. RESIDENCE. THE SAMPLING LOCATIONS ARE SHOWN IN FIGURE 17.

METHYLENE CHLORIDE WAS FOUND IN THREE OF THE FOUR SAMPLES COLLECTED AT LOCATION AA-01, ONCE AT THE LOCATION NEXT TO THE COX, SR. RESIDENCE, AND ONCE AT THE LOCATION NEXT TO THE COX, JR. RESIDENCE. PCE WAS FOUND IN TWO OF THE SAMPLES FROM LOCATION AA-01 AT A LEVEL OF 3.7 PPB AND AN ESTIMATED LEVEL OF 4.5 PPB. FREON 113 WAS TENTATIVELY IDENTIFIED AS BEING AN AIR CONTAMINANT AT ALL LOCATIONS, BUT IT WAS NOT IDENTIFIED DURING ALL SAMPLING EVENTS. THE HIGHEST FREON 113 CONCENTRATIONS WERE FOUND AT LOCATION AA-01. THE ONLY TENTATIVELY IDENTIFIED ORGANIC COMPOUNDS WERE ALIPHATIC ALDEHYDES, WHICH WERE FOUND AT ALL LOCATIONS.

NO CONSISTENT PATTERN OF AIR CONTAMINATION WAS FOUND OTHER THAN PCE, WHICH WAS DETECTED WHEN THE WIND BLEW UP THE FACES OF THE COX LOBE. PCE WAS FOUND DURING SAMPLING EVENTS WHEN THE AIR SPEED WAS AT ITS LOWEST, WHICH POTENTIALLY INDICATES THAT THE CONTAMINATION SOURCE WAS CLOSE TO THE SAMPLING LOCATION.

THE SAMPLES FROM LOCATION AA-01 CONTAINED THE LARGEST NUMBER OF CONTAMINANTS. METHYLENE CHLORIDE, FREON 113, AND ALIPHATIC ALDEHYES HAVE NOT PREVIOUSLY BEEN IDENTIFIED WITH WASTE DISPOSAL ACTIVITIES NOR WERE THEY FOUND IN ANY OTHER MEDIA SAMPLED DURING THE RI.

#SSR

6.0 SUMMARY OF SITE RISKS

CERCLA DIRECTS THAT EPA MUST PROTECT HUMAN HEALTH AND THE ENVIRONMENT FROM CURRENT AND FUTURE EXPOSURE TO HAZARDOUS SUBSTANCES AT SUPERFUND SITES. IN ORDER TO ASSESS THE CURRENT AND FUTURE RISKS FROM THE TRI-CITY INDUSTRIAL DISPOSAL SITE, A BASELINE RISK ASSESSMENT WAS CONDUCTED AS PART OF THE REMEDIAL INVESTIGATION. THIS SECTION OF THE RECORD OF DECISION SUMMARIZES THE AGENCY'S FINDINGS CONCERNING THE IMPACT TO HUMAN HEALTH AND THE ENVIRONMENT IF CONTAMINATED MEDIA (I.E., SOILS, GROUND WATER) AT THE SITE WERE NOT REMEDIATED. THE BASELINE RISK ASSESSMENT IS INCLUDED IN THE RI REPORT AS APPENDIX F.

6.1 HUMAN HEALTH RISKS

6.1.1 CONTAMINANTS OF CONCERN

TABLE 14 PROVIDES A COMPREHENSIVE LIST OF THE CONTAMINANTS IDENTIFIED AS CHEMICALS OF POTENTIAL CONCERN AT THE SITE IN THEIR VARIOUS MEDIA. THE CONTAMINANTS OF CONCERN ARE TEN ORGANIC CHEMICALS AND NINE INORGANIC CHEMICALS. TABLE 14 ALSO INCLUDES THE REASONABLE MAXIMUM EXPOSURE LIMITS WHICH WERE USED IN CALCULATING THE CARCINOGENIC AND NONCARCINOGENIC RISKS ASSOCIATED WITH EACH CHEMICAL.

6.1.2 EXPOSURE ASSESSMENT

THE OBJECTIVE OF THE EXPOSURE ASSESSMENT IS TO ESTIMATE THE TYPE AND MAGNITUDE OF POTENTIAL EXPOSURES TO THE CHEMICALS OF CONCERN THAT ARE PRESENT AT THE SITE. THE RESULTS OF THE EXPOSURE ASSESSMENT ARE COMBINED WITH CHEMICAL-SPECIFIC TOXICITY INFORMATION TO CHARACTERIZE POTENTIAL RISKS.

THE PRIMARY HUMAN RECEPTORS AT THE SITE ARE THE INHABITANTS OF THE FOUR RESIDENCES IN THE FORMER DISPOSAL AREA. THESE INDIVIDUALS MAY CURRENTLY BE EXPOSED TO SITE-RELATED CONTAMINANTS IN SURFACE SOIL, SURFACE WATER, SEDIMENT, AND AIR. POTENTIAL FUTURE EXPOSURES WOULD INCLUDE THOSE PATHWAYS, AS WELL AS GROUND WATER/SPRING WATER AND SUB-SURFACE SOILS. ALTHOUGH THE GROUND WATER/SPRING WATER IS NOT CURRENTLY BEING USED AS A DRINKING WATER SOURCE, EPA AND THE COMMONWEALTH OF KENTUCKY HAVE CLASSIFIED THE AQUIFER AS A CLASS II-B AQUIFER, A RESOURCE WHICH SHOULD BE MAINTAINED AT DRINKING WATER QUALITY.

THE CURRENT EXPOSURE PATHWAYS CONSIDERED WERE (1) DERMAL CONTACT AND INCIDENTAL INGESTION OF SURFACE SOILS, (2) INGESTION OF GARDEN CROPS RAISED ON-SITE, (3) INGESTION OF BEEF CATTLE RAISED ON-SITE, AND (4) INHALATION OF VOLATILE ORGANIC COMPOUNDS (VOCS) IN AMBIENT AIR. THE FUTURE PATHWAYS CONSIDERED INCLUDE THE CURRENT PATHWAYS AND THE FOLLOWING: (1) DERMAL CONTACT AND INCIDENTAL INGESTION OF EXPOSED SUB-SURFACE SOILS, (2) INGESTION OF SPRING WATER, AND (3) INHALATION OF VOCS RELEASED FROM SPRING WATER WHILE SHOWERING.

TABLE 15 PROVIDES THE EXPOSURE AND INTAKE ASSUMPTIONS WHICH WERE USED IN THE BASELINE RISK ASSESSMENT.

6.1.3 TOXICITY ASSESSMENT

THE TOXICITY ASSESSMENT WAS CONDUCTED TO FURTHER DETERMINE THE POTENTIAL HAZARD POSED BY THE CHEMICALS OF CONCERN FOR WHICH EXPOSURE PATHWAYS HAVE BEEN IDENTIFIED. AVAILABLE EVIDENCE WAS WEIGHED WITH REGARDS TO THE POTENTIAL OF PARTICULAR CONTAMINANTS TO CAUSE ADVERSE EFFECTS IN EXPOSED INDIVIDUALS AND TO PROVIDE, WHERE POSSIBLE, AN ESTIMATE OF THE RELATIONSHIP BETWEEN THE EXTENT OF EXPOSURE TO A CONTAMINANT AND THE INCREASED LIKELIHOOD AND/OR SEVERITY OF ADVERSE EFFECTS.

CANCER POTENCY FACTORS (CPFS) HAVE BEEN DEVELOPED BY EPA'S CARCINOGENIC ASSESSMENT GROUP FOR ESTIMATING EXCESS LIFETIME CANCER RISKS ASSOCIATED WITH EXPOSURE TO POTENTIALLY CARCINOGENIC CHEMICALS. CPFS, WHICH ARE EXPRESSED IN UNITS OF (MG/KG/DAY)-1, ARE MULTIPLIED BY THE ESTIMATED INTAKE OF A POTENTIAL CARCINOGEN, IN MG/KG/DAY, TO PROVIDE AN UPPER-BOUND ESTIMATE OF THE EXCESS LIFETIME CANCER RISK ASSOCIATED WITH EXPOSURE AT THAT INTAKE LEVEL. THE TERM "UPPER-BOUND" REFLECTS THE CONSERVATIVE ESTIMATE OF THE RISKS CALCULATED FROM THE CPF. USE OF THIS APPROACH MAKES UNDERESTIMATION OF THE ACTUAL CANCER RISK HIGHLY UNLIKELY. CPFS ARE DERIVED FROM THE RESULTS OF HUMAN EPIDEMIOLOGICAL STUDIES OR CHRONIC ANIMAL BIOASSAYS TO WHICH ANIMAL-TO-HUMAN EXTRAPOLATION AND UNCERTAINTY FACTORS HAVE BEEN APPLIED.

REFERENCE DOSES (RFDS) HAVE BEEN DEVELOPED BY EPA FOR INDICATING THE POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM EXPOSURE TO CHEMICALS EXHIBITING NONCARCINOGENIC (SYSTEMIC) EFFECTS. RFDS, WHICH ARE EXPRESSED IN UNITS OF MG/KG/DAY, ARE ESTIMATES OF LIFETIME DAILY EXPOSURE LEVELS FOR HUMANS, INCLUDING SENSITIVE INDIVIDUALS, WHICH WILL RESULT IN NO ADVERSE HEALTH EFFECTS. ESTIMATED INTAKES OF CHEMICALS FROM ENVIRONMENTAL MEDIA (I.E., THE AMOUNT OF CHEMICAL INGESTED FROM CONTAMINATED DRINKING WATER) CAN BE COMPARED TO THE RFD. RFDS ARE DERIVED FROM HUMAN EPIDEMIOLOGICAL STUDIES OR ANIMAL STUDIES TO WHICH UNCERTAINTY FACTORS HAVE BEEN APPLIED (I.E., TO ACCOUNT FOR THE USE OF ANIMAL DATA TO PREDICT EFFECTS ON HUMANS). THESE UNCERTAINTY FACTORS HELP ENSURE THAT THE RFDS WILL NOT UNDERESTIMATE THE POTENTIAL FOR ADVERSE NONCARCINOGENIC EFFECTS TO OCCUR.

THE AGENCY HAS DERIVED CPFS AND RFDS FOR THE CONTAMINANTS OF CONCERN AT THE SITE FOR USE IN DETERMINING THE UPPER-BOUND LEVEL OF CANCER RISK AND NON-CANCER HAZARD FROM EXPOSURE TO A GIVEN LEVEL OF CONTAMINATION. THESE VALUES ARE PROVIDED IN TABLES 16 AND 17, RESPECTIVELY.

6.1.4 RISK CHARACTERIZATION

THE RISK CHARACTERIZATION STEP OF THE BASELINE RISK ASSESSMENT PROCESS INTEGRATES THE TOXICITY AND EXPOSURE ASSESSMENTS INTO QUANTITATIVE AND QUALITATIVE EXPRESSIONS OF RISK. THE OUTPUT OF THIS PROCESS IS A CHARACTERIZATION OF THE SITE-RELATED POTENTIAL NONCARCINOGENIC AND CARCINOGENIC HEALTH EFFECTS.

EXCESS LIFETIME CANCER RISKS ARE DETERMINED BY MULTIPLYING THE INTAKE LEVEL WITH THE CANCER POTENCY FACTOR. THESE RISKS ARE PROBABILITIES THAT ARE GENERALLY EXPRESSED IN SCIENTIFIC NOTATION (I.E., 1 X (10-6) OR 1E-6). AN EXCESS LIFETIME CANCER RISK OF 1E-6 INDICATES THAT, AS A PLAUSIBLE UPPER-BOUND, AN INDIVIDUAL HAS A ONE IN ONE MILLION CHANCE OF DEVELOPING CANCER AS A RESULT OF SITE-RELATED EXPOSURE TO A CARCINOGEN OVER A 70-YEAR LIFETIME UNDER THE SPECIFIC EXPOSURE CONDITIONS AT A SITE.

EPA HAS SET AN ACCEPTABLE CARCINOGENIC RISK RANGE OF 1E-4 TO 1E-6, BUT PREFERS THAT REMEDIATION OF SUPERFUND SITES ACHIEVE A RESIDUAL CANCER RISK NO GREATER THAN 1E-6. HOWEVER, DEPENDING UPON SITE FACTORS, A RISK OF 1E-4 MAY BE CONSIDERED PROTECTIVE. THE CALCULATED UPPER-BOUND RISKS FROM THE INGESTION OF BEEF FROM CATTLE RAISED ON-SITE WOULD FALL JUST OUTSIDE THE LOWER LIMITS OF THIS RISK RANGE (2E-4). THIS RISK LEVEL IS BASED ON THE DETECTION OF PAHS AND ONE SPECIES OF PCB IN ONE OUT OF TWENTY SURFACE SOIL SAMPLES COLLECTED DURING THE REMEDIAL INVESTIGATION. THE REASONABLE MAXIMUM EXPOSURE (RME) WAS BASED ON THIS DETECTION AND HALF THE DETECTION LIMIT FOR THE OTHER SAMPLES. BECAUSE OF THIS LOW FREQUENCY OF DETECTION, IT IS RECOMMENDED THAT THE PRESENCE OF THESE CARCINOGENIC COMPOUNDS BE VERIFIED THROUGH ADDITIONAL SAMPLING. THE RISK ASSESSMENT SHOULD THEN BE REVISED TO INCLUDE THE NEW DATA.

TWO OF THE FUTURE EXPOSURE PATHWAYS, INGESTION OF SPRING WATER AND INHALATION OF VOCS WHILE SHOWERING, EXCEED EPA'S ACCEPTABLE CARCINOGENIC RISK RANGE. THE CALCULATED RISK LEVELS ARE 2E-3 AND 1E-4, RESPECTIVELY. THE CONTAMINATED SPRING WATER SHOULD BE REMEDIATED.

THE CARCINOGENIC UPPER-BOUND RISK FOR EACH OF THE EXPOSURE PATHWAYS(CURRENT AND FUTURE) IDENTIFIED AT THE SITE ARE SUMMARIZED BELOW:

	LIFETIME CANCER RISK	
EXPOSURE PATHWAYS	CURRENT	FUTURE
INHALATION OF AIR	2.5E-5	2.5E-5
INGESTION OF SPRING WATER	NA	1.8E-3
INHALATION OF VOCS WHILE SHOWERING	NA	1.2E-4
INGESTION OF GARDEN CROPS	8.9E-5	8.9E-5
INGESTION OF BEEF	2.3E-4	2.3E-4
CONTACT WITH SURFACE SOILS	7.3E-7	7.3E-7
CONTACT WITH SUB-SURFACE SOILS	NA	2.6E-7
TOTAL RISK	3.4E-4	2.3E-3

NA - NOT APPLICABLE

POTENTIAL CONCERN FOR NONCARCINOGENIC EFFECTS OF A SINGLE CONTAMINANT IN A SINGLE MEDIUM IS EXPRESSED AS THE HAZARD QUOTIENT (HQ) (OR THE RATIO OF THE ESTIMATED INTAKE DERIVED FROM THE

CONTAMINANT CONCENTRATION IN A GIVEN MEDIUM TO THE CONTAMINANT'S REFERENCE DOSE). BY ADDING THE HQS FOR ALL CONTAMINANTS WITHIN A MEDIUM OR ACROSS ALL MEDIA TO WHICH A GIVEN POPULATION MAY BE REASONABLY EXPOSED, THE HAZARD INDEX (HI) CAN BE GENERATED. THE HI PROVIDES A USEFUL REFERENCE POINT FOR GAUGING THE POTENTIAL SIGNIFICANCE OF MULTIPLE CONTAMINANT EXPOSURES WITHIN A SINGLE MEDIUM OR ACROSS MEDIA. THE HQS AND HIS FOR THE EXPOSURE PATHWAYS (CURRENT AND FUTURE) IDENTIFIED AT THE SITE ARE SUMMARIZED BELOW:

	HAZARD QUOTIENT	
EXPOSURE PATHWAYS	CURRENT	FUTURE
INHALATION OF AIR	6.9	6.9
INGESTION OF SPRING WATER	NA	1.9
INHALATION OF VOCS WHILE SHOWERING	NA	3.9E-1
INGESTION OF GARDEN CROPS	4.8E-2	4.8E-2
INGESTION OF BEEF	1.1E-2	1.1E-2
CONTACT WITH SURFACE SOILS	2.4E-1	2.4E-1
CONTACT WITH SUB-SURFACE SOILS	NA	6.1E-1
HAZARD INDEX	7.2	1.0E+1

NA - NOT APPLICABLE

THE HQ FOR THE AIR PATHWAY AND THE DRINKING WATER PATHWAY BOTH EXCEED UNITY. THE HQ FOR THE DRINKING WATER PATHWAY WAS BASED ON THE PRESENCE OF VARIOUS CHEMICALS AT CONCENTRATIONS EXCEEDING EPA'S MAXIMUM CONTAMINANT LEVELS (MCLS) FOR DRINKING WATER.

THE HQ FOR THE AIR PATHWAY WAS BASED ON ONE CHEMICAL, TETRACHLOROETHENE, WHICH WAS DETECTED IN TWO OUT OF TWELVE SAMPLES TAKEN ON-SITE. THE RME WAS BASED ON THESE TWO DETECTIONS AND HALF OF THE DETECTION LIMIT FOR THE OTHER TEN SAMPLES. A SOURCE FOR THE PRESENCE OF THIS CONTAMINANT IN THE AIR HAS NOT BEEN IDENTIFIED. ADDITIONAL SAMPLING IS RECOMMENDED TO IDENTIFY AND DEFINE ANY SOURCES. THE RISK CHARACTERIZATION SHOULD THEN BE REVISED TO INCLUDE THE NEW DATA.

6.1.5 RISK UNCERTAINTY

THERE IS A GENERALLY RECOGNIZED UNCERTAINTY IN HUMAN RISK VALUES DEVELOPED FROM EXPERIMENTAL DATA. THIS IS PRIMARILY DUE TO THE UNCERTAINTY OF EXTRAPOLATION IN THE AREAS OF (1) HIGH TO LOW DOSE EXPOSURE AND (2) ANIMAL DATA TO VALUES THAT ARE PROTECTIVE OF HUMAN HEALTH. THE SITE SPECIFIC UNCERTAINTY IS MAINLY IN THE DEGREE OF ACCURACY OF THE EXPOSURE ASSUMPTIONS. MOST OF THE EXPOSURE ASSUMPTIONS USED IN THIS, AND ANY, RISK ASSESSMENT HAVE NOT BEEN FULLY VERIFIED. FOR EXAMPLE, THE DEGREE OF CHEMICAL ABSORPTION FROM THE GUT OR THROUGH THE SKIN OR THE AMOUNT OF SOIL CONTACT THAT MAY OCCUR IS NOT KNOWN WITH CERTAINTY. GENERALLY ACCEPTED DEFAULT VALUES PROVIDED IN AGENCY GUIDANCE WERE USED WHEN AVAILABLE.

IN THE PRESENCE OF SUCH UNCERTAINTY, THE AGENCY AND THE RISK ASSESSOR HAVE THE OBLIGATION TO MAKE CONSERVATIVE ASSUMPTIONS SUCH THAT THE LIKELIHOOD IS VERY SMALL, APPROACHING ZERO, FOR THE ACTUAL HEALTH RISK TO BE GREATER THAN THAT DETERMINED THROUGH THE RISK ASSESSMENT PROCESS. ON THE OTHER HAND, THE PROCESS IS NOT INTENDED TO YIELD CONSERVATIVE RISKS VALUES THAT HAVE NO BASIS IN REALITY. THAT BALANCE WAS KEPT IN MIND IN THE DEVELOPMENT OF EXPOSURE ASSUMPTIONS AND PATHWAYS AND IN THE INTERPRETATION OF DATA AND GUIDANCE FOR THIS BASELINE RISK ASSESSMENT.

6.2 ENVIRONMENTAL RISKS

NO ECOLOGICAL SURVEYS OR IMPACT ASSESSMENTS WERE PERFORMED ON THE SITE PRIOR TO THE RI. AS PART

OF THE SCOPE OF RI ACTIVITIES, AN AQUATIC SURVEY OF BRUSHY FORK CREEK WAS PERFORMED IN JULY 1989 AND REPORTED IN THE RI REPORT. SURVEYS OF TERRESTRIAL SPECIES (I.E, PLANTS, ANIMALS, AND BIRDS) WERE NOT INCLUDED IN THE SCOPE OF WORK.

SAMPLING STATIONS FOR THE AQUATIC SURVEY WERE ESTABLISHED ALONG THE CREEK AND CORRESPONDED WITH SURFACE WATER SAMPLING LOCATIONS WHEN POSSIBLE. THE SAMPLING STATIONS ARE SHOWN IN FIGURE 16. PHYSICAL AND CHEMICAL STREAM PARAMETERS WERE MEASURED AT ALL STATIONS. BENTHIC MACROINVERTEBRATES WERE QUANTITATIVELY SAMPLED AT EACH STATION, IDENTIFIED, AND THE DIVERSITY AND TOLERANCE LEVELS OF EACH POPULATION WERE DETERMINED IN THE LABORATORY. BENTHIC MACROINVERTEBRATES REPRESENT AN IDEAL INDICATOR COMMUNITY OF WATER QUALITY BECAUSE THEY ARE FAIRLY IMMOBILE, ABUNDANT, EASILY COLLECTED, AND EXHIBIT A VARIED DEGREE OF TOLERANCE TO POLLUTANTS. IN ADDITION TO THE BENTHIC MACROINVERTEBRATE COLLECTIONS, THE FISH POPULATION WAS ANALYZED TO DETERMINE THE ABILITY OF THE STREAM TO SUPPORT EDIBLE FISH POPULATIONS, AND, IF SO, IF THIS POPULATION POSED A THREAT TO HUMAN HEALTH BY BEING UTILIZED AS A FOOD SOURCE.

DIVERSITY INDICES OF THE BENTHIC MACROINVERTEBRATE POPULATIONS WERE CALCULATED AT EACH STATION. HIGH DIVERSITIES INDICATE THAT THE INDIVIDUALS COMPRISING A POPULATION ARE DISTRIBUTED AMONG A LARGE NUMBER OF SPECIES. HIGH DIVERSITIES ARE TYPICALLY CHARACTERISTIC OF HIGH WATER QUALITY STREAMS WHERE THE BENTHIC MACROINVERTEBRATE POPULATION CONSISTS OF A LARGE NUMBER OF LESS TOLERANT SPECIES WITH EACH SPECIES REPRESENTED BY A FEW INDIVIDUALS. LOW DIVERSITIES ARE COMMONLY ASSOCIATED WITH POLLUTED OR DISTURBED STREAMS IN WHICH SPECIES TOLERANT OF POLLUTION OR DISTURBANCE REPLACE THE LESS TOLERANT SPECIES IN THE POPULATION. THE RESULT IS A SMALL NUMBER OF TOLERANT SPECIES WITH EACH SPECIES REPRESENTED BY A LARGE NUMBER OF INDIVIDUALS.

THE STATIONS HAD SIMILAR PHYSIOCHEMICAL PARAMETERS (I.E., TEMPERATURE, PH, DISSOLVED OXYGEN CONCENTRATION, AND SPECIFIC CONDUCTIVITY) AND THE BENTHIC POPULATIONS SAMPLED AT EACH STATION COULD BE COMPARED DIRECTLY. THE DIVERSITY INDICES VARIED ONLY SLIGHTLY AND DID NOT INDICATE ANY DRASTIC CHANGES BETWEEN THE STATIONS. THE INDICES WERE MODERATELY HIGH INDICATING GOOD TO FAIR WATER QUALITY AND THE INDIVIDUALS WERE EVENLY DISTRIBUTED AMONG THE SPECIES. ALTHOUGH THERE WERE SPECIES OR GROUPS WHICH DOMINATED THE POPULATION AT A GIVEN STATION, A LARGE NUMBER OF SPECIES WITH FEW REPRESENTATIVES MAINTAINED THE DIVERSITY AT EACH STATION.

THE BIOTIC INDICES INCREASED SLIGHTLY AT THE DOWNSTREAM STATIONS, TC-AB-03 AND TC-AB-04, SUGGESTING THE POSSIBILITY OF SOME ORGANIC ENRICHMENT ENTERING THE CREEK FROM A NON-HUMAN SOURCE. HOWEVER, THE HIGH DIVERSITY AT THE SAMPLING STATIONS INDICATES THAT THERE ARE NO SERIOUS POINT SOURCE POLLUTANTS ENTERING THE STREAM. THE POSSIBILITY EXISTS THAT THIS ENRICHMENT IS A RESULT OF RESIDENTIAL AND AGRICULTURAL SOURCES RATHER THAN THE TRI-CITY SITE.

AN ASSESSMENT OF THE FISH POPULATION OF BRUSHY FORK CREEK WAS MADE AT THE DOWNSTREAM STATION (TC-AB-04) IN ORDER TO DETERMINE SPECIES COMPOSITION, RELATIVE ABUNDANCE, AND THE PRESENCE OF EDIBLE SPECIES. FIVE SPECIES OF JUVENILE FISH WERE COLLECTED FROM THE CREEK, INDICATING THAT NATURAL REPRODUCTION OF THESE SPECIES WAS OCCURRING WITHIN THIS PARTICULAR STREAM REACH. THE FISH THAT WERE COLLECTED OR OBSERVED WERE TOO SMALL TO BE A FOOD SUPPLY AND WERE NOT THE TYPICAL SPECIES FOR SPORT FISHING OR HUMAN CONSUMPTION.

ELEVEN SEDIMENT SAMPLES WERE COLLECTED IN JULY 1989 DURING THE RI. THE SAMPLING LOCATIONS ARE SHOWN IN FIGURE 16. THE DATA FROM THE ANALYSES OF THE SEDIMENT SAMPLES WAS DISCUSSED IN SECTION 5.3.4.

ALTHOUGH SEDIMENT QUALITY CRITERIA HAVE NOT BEEN ESTABLISHED FOR METALS, EFFECTS LEVELS HAVE BEEN ESTIMATED FOR AQUATIC BIOTA BY THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) BASED ON THE RESPONSE OF TEST ORGANISMS TO SINGLE TOXINS, INCLUDING METALS. THE EFFECTS RANGE-LOWER (ER-L) VALUE IS AN APPROXIMATION OF THE CONCENTRATION OF A SINGLE ANALYTE AT WHICH ADVERSE EFFECTS WERE FIRST DETECTED. ER-L VALUES ARE NOT TO BE CONSTRUED AS NOAA STANDARDS OR

CRITERIA. AND, SINCE THERE IS A LOW DEGREE OF CONFIDENCE IN THE ACCURACY OF SOME OF THE VALUES DUE TO INCONSISTENT OR INSUFFICIENT DATA, THESE VALUES MAY NOT BE ECOLOGICALLY PROTECTIVE. TABLE 18 SHOWS THE ER-L VALUES FOR THE METALS PERTAINING TO THE SITE AND THE CORRESPONDING DEGREES OF CONFIDENCE.

SEDIMENT SAMPLES 01, 04, AND 05 WERE LOCATED ON TRIBUTARIES TO BRUSHY FORK CREEK WHICH WERE NOT INFLUENCED BY SURFACE AND GROUNDWATER ORIGINATING FROM THE TRI-CITY SITE. WITH THE EXCEPTION OF SD-05, THE METALS LEVELS DETECTED IN THESE SAMPLES WERE BELOW THE ER-L. THE NICKEL LEVEL IN SD-05 WAS EQUIVALENT TO THE ER-L.

SEDIMENT SAMPLE SD-06 WAS LOCATED IN THE DRAINAGE PATHWAY FROM THE UNNAMED SPRING TO THE SOUTHEAST OF THE COX LOBE. THE ER-L VALUES FOR CHROMIUM AND LEAD WERE SUBSTANTIALLY EXCEEDED IN THIS SAMPLE. THE LEVEL OF CHROMIUM DETECTED WAS TWICE THE ER-L. THE ESTIMATED DETECTED LEVEL OF 610 PPM LEAD WAS MORE THAN SEVENTEEN TIMES THE ER-L. THE ESTIMATED DETECTED LEVEL OF MERCURY WAS MORE THAN ONE-AND-A HALF TIMES THE ER-L. MERCURY WAS NOT DETECTED IN THE SEDIMENTS AT ANY OTHER SAMPLING LOCATIONS.

EVEN THOUGH NONE OF THE METALS OBSERVED IN THE SEDIMENT SAMPLE SD-06 WERE OBSERVED IN THE DOWNSTREAM SURFACE WATER SAMPLE SW-06, METALS WERE DETECTED IN THE CORRESPONDING DOWNSTREAM SEDIMENT SAMPLE SD-11. THE ER-L FOR LEAD WAS EXCEEDED IN SAMPLE SD-11 BY 6 PPM. THE LOCATION OF SAMPLE SD-11 IS DOWNSTREAM OF BOTH THE UNNAMED SPRING AND THE COX SPRING.

SEDIMENT SAMPLE SD-08 WAS LOCATED DOWNSTREAM OF THE KLAPPER SPRING. THE DETECTED METALS WERE BELOW THE ER-L. SAMPLE SD-02 WAS LOCATED ON BRUSHY FORK CREEK DOWNSTREAM OF THE UNNAMED SPRING, THE COX SPRING, AND THE KLAPPER SPRING. ASSUMING THAT THIS LOCATION IS AN AREA OF DEPOSITION, THIS SAMPLE REPRESENTED THE COMBINED DISCHARGE FROM THESE THREE PATHWAYS. THE LEVELS OF THE DETECTED METALS WERE BELOW THE ER-L AND NO METALS OF CONCERN WERE OBSERVED IN THE CORRESPONDING WATER COLUMN SAMPLE SW-02.

SEDIMENT SAMPLE SD-09 WAS LOCATED AT THE CONFLUENCE OF SEEP #1 AND THE CATTLE SPRING DRAINAGE. ARSENIC, CHROMIUM, LEAD, AND NICKEL WERE DETECTED IN THIS SAMPLE. THE LEAD LEVEL WAS 1 PPM ABOVE THE ER-L.

SEDIMENT SAMPLE SD-10 WAS LOCATED DOWNSTREAM OF SD-09 AND BEFORE THE CONFLUENCE WITH BRUSHY FORK CREEK. ARSENIC, CHROMIUM, LEAD, AND NICKEL WERE DETECTED IN CONCENTRATIONS SIMILAR TO THE LEVELS IN SD-09. THE LEAD LEVEL IN SD-10 WAS ALSO 1 PPM ABOVE THE ER-L.

SEDIMENT SAMPLE SD-03 WAS LOCATED IN BRUSHY FORK CREEK DOWNSTREAM OF ALL SURFACE WATER DRAINAGE FEATURES ORIGINATED FROM THE SITE. LEAD AND NICKEL WERE DETECTED IN THIS SAMPLE AT LEVELS BELOW THE ER-L. NO METALS OF CONCERN WERE DETECTED IN THE CORRESPONDING WATER COLUMN SAMPLE SW-03.

REPRESENTATIVES FROM EPA AND THE FISH AND WILDLIFE SERVICE (FWS) CONDUCTED A CURSORY ECOLOGICAL RECONNAISSANCE OF THE TRI-CITY SITE IN AUGUST 1990. THE OBJECTIVE OF THE RECONNAISSANCE WAS TO DETERMINE IF SUITABLE FEEDING HABITAT FOR THE ENDANGERED INDIANA BAT, GRAY BAT, AND BALD EAGLE EXISTED IN THE FIRST AND SECOND ORDER STREAMS DOWNGRADIENT OF THE SITE. SINCE THE INDIANA BAT AND GRAY BAT ARE INSECTIVOROUS, A BRIEF AQUATIC MACROINVERTEBRATE STUDY WAS CONDUCTED ON BRUSHY FORK CREEK. IN ADDITION, A BRIEF BOTANICAL SURVEY AND FISH SURVEY WERE CONDUCTED ON THE CREEK.

CONDUCTIVITY, PH, AND TEMPERATURE WERE MEASURED AT THE COX SPRING, KLAPPER SPRING, AND IN BRUSHY FORK CREEK DURING THE RECONNAISSANCE. CONDUCTIVITY WAS FOUND TO BE SLIGHTLY ELEVATED IN THE COX AND KLAPPER SPRINGS AS COMPARED TO BRUSHY FORK CREEK. THE PH WAS CIRCUMNEUTRAL AT ALL STATIONS. ALL THREE PARAMETERS WERE OBSERVED WITHIN ADEQUATE RANGES WHICH WOULD SUPPORT THE GROWTH AND MAINTENANCE OF ENDEMIC AQUATIC BIOTA.

STREAM FLOW IN BRUSHY FORK CREEK DURING THE RECONNAISSANCE WAS EXTREMELY LOW. FISH AND AQUATIC MACROINVERTEBRATES WERE CONCENTRATED IN POOLS WHICH WERE ISOLATED FROM EACH OTHER. SIMILAR SPECIES WERE COLLECTED DURING THE RECONNAISSANCE AS WERE COLLECTED DURING THE RI.

EPA DETERMINED THAT BRUSHY FORK CREEK WAS APPARENTLY A HEALTHY STREAM SUPPORTING DIVERSE COMMUNITIES OF MACROINVERTEBRATES AND FISH. THE HATCHING AQUATIC INSECTS IN THE CREEK WOULD HAVE TO BE HIGHLY CONTAMINATED TO CONSTITUTE A SERIOUS THREAT TO THE BATS SINCE IT APPEARED DOUBTFUL THAT FORAGING INDIANA OR GRAY BATS WOULD BE ABLE TO FIND AND CONSUME ENOUGH EMERGING INSECTS ALONG THIS STREAM TO CONSTITUTE A SIGNIFICANT PORTION OF THEIR DIET. OBVIOUS SIGNS OF BIOLOGICAL CONTAMINATION WERE NOT OBSERVED.

SINCE A TOXICOLOGICAL EXAMINATION OF THE SITE HAS NOT BEEN CONDUCTED, FWS RECOMMENDED THAT AN ECOLOGICAL CONTAMINANT MONITORING PROGRAM BE INCLUDED AS PART OF THE SELECTED REMEDIAL ALTERNATIVE FOR THE TRI-CITY SITE. THIS PROGRAM SHOULD CONSIST OF THREE MONITORING EPISODES INVOLVING BIOASSAYS AND TISSUE ANALYSES. THE INITIAL MONITORING EPISODE SHOULD BE CONDUCTED CONCURRENTLY WITH THE CONFIRMATORY SAMPLING DURING THE REMEDIAL DESIGN (RD) PHASE TO ESTABLISH THE BASELINE CONDITIONS. THE SECOND MONITORING EPISODE SHOULD BE CONDUCTED ONE YEAR LATER TO IDENTIFY ANY SHORT-TERM SITE-RELATED IMPACTS. THE THIRD MONITORING EPISODE SHOULD BE CONDUCTED FIVE YEARS AFTER IMPLEMENTATION OF THE SELECTED REMEDY TO IDENTIFY ANY LONG-TERM SITE-RELATED IMPACTS. THE MONITORING EPISODES SHOULD ALSO BE CONDUCTED DURING DIFFERENT SEASONS TO BE REPRESENTATIVE OF SITE CONDITIONS.

IF THERE HAS BEEN NO DEMONSTRABLE INDICATION OF SITE-RELATED ECOLOGICAL DEGRADATION AFTER THE THREE MONITORING EPISODES, FURTHER ECOLOGICAL MONITORING WOULD NOT BE NECESSARY. HOWEVER, IF THE MONITORING EPISODES INDICATE THAT SITE-RELATED ECOLOGICAL DEGRATION HAS OCCURRED (OR IS OCCURRING), HISTOPATHOLOGICAL STUDIES MAY BE NECESSARY TO FURTHER DEFINE THE IMPACT. THE ADDITIONAL MEASURES NECESSARY TO MITIGATE THE THREAT TO THE ENVIRONMENT WOULD BE IMPLEMENTED IN OPERABLE UNIT #2.

CONTINUED MONITORING OF BRUSHY FORK CREEK FOR INCREASES IN WATER COLUMN AND SEDIMENT CONTAMINATION WOULD ALSO BE INCLUDED IN THE ECOLOGICAL CONTAMINANT MONITORING PROGRAM. IN ADDITION, FWS RECOMMENDED REMEDIATION OF THE CONTAMINATED SPRING(S) SINCE VOLATILE ORGANIC COMPOUNDS ARE ENTERING BRUSHY FORK CREEK VIA THIS PATHWAY.

6.3 SUMMARY

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS ROD, MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT.

THE HEALTH RISK POSED BY THIS SITE IS PRIMARILY FROM THE FUTURE USE OF THE GROUNDWATER/SPRING WATER AS A POTABLE SOURCE. THIS RISK IS DUE TO THE PRESENCE OF VOCS AT CONCENTRATIONS ABOVE MCLS AND NON-ZERO MCLGS. THESE CONTAMINANTS SHOULD BE REMEDIATED.

THE BASELINE RISK ASSESSMENT ALSO SHOWS A POTENTIAL HEALTH RISK ASSOCIATED WITH RAISING BEEF CATTLE AND CULTIVATING GARDENS ON-SITE. HOWEVER, THIS POTENTIAL RISK IS BASED THE DETECTION OF CONTAMINANTS IN ONE OUT OF TWENTY ON-SITE SURFACE SOIL SAMPLES. BECAUSE OF THE LOW FREQUENCY OF DETECTION, THE PRESENCE OF SURFACE SOIL CONTAMINATION SHOULD BE VERIFIED. THE PRESENCE OF ANY AIR CONTAMINANTS SHOULD ALSO BE CONFIRMED. TETRACHLOROETHENE WAS DETECTED IN TWO OF TWELVE AIR SAMPLES COLLECTED DURING THE RI, BUT NO SOURCE HAS BEEN IDENTIFIED.

THE ECOLOGICAL IMPACTS TO BRUSHY FORK CREEK CURRENTLY ORIGINATING FROM THE SITE HAVE BEEN DETERMINED TO BE MINIMAL. THE CREEK IS APPARENTLY A HEALTHY STREAM SUPPORTING DIVERSE COMMUNITIES OF MACROINVERTEBRATES AND FISH, AND NO DATA HAS BEEN COLLECTED TO DATE TO INDICATE

THAT THE CREEK HAS BEEN ADVERSELY AFFECTED. ALSO, THERE IS NOT ADEQUATE FEEDING HABITAT TO SUPPORT THE ENDANGERED BATS AND THE BALD EAGLE WITHIN THE STREAM REACH OF THE CREEK AND ITS TRIBUTARIES.

THE SEDIMENT SAMPLING CONDUCTED DURING THE RI REVEALED LEVELS OF CHROMIUM AND LEAD IN ONE SAMPLE THAT SUBSTANTIALLY EXCEEDED EFFECTS LEVELS ESTIMATED BY NOAA FOR AQUATIC BIOTA. IN ADDITION, MERCURY WAS DETECTED IN ONLY THAT SAMPLE AND AT A LEVEL ABOVE THE ER-L. LEAD WAS ALSO DETECTED IN A DOWNSTREAM SAMPLE AT A LEVEL SLIGHTLY ABOVE THE ER-L. CONSEQUENTLY, THE EXTENT OF INORGANIC CONTAMINATION IN THE AREA OF THESE SEDIMENT SAMPLES SHOULD BE VERIFIED. SINCE THE ER-L FOR LEAD WAS EXCEEDED BY ONLY 1 PPM IN TWO OTHER SAMPLES, AND THE DEGREE OF CONFIDENCE IN THE LEAD ER-L AS AN INDICATOR OF ADVERSE EFFECTS IN AQUATIC BIOTA IS MODERATE, ADDITIONAL ACTION IN THE VICINITY OF THESE SAMPLES IS NOT CURRENTLY JUSTIFIED.

SINCE A TOXICOLOGICAL EXAMINATION HAS NOT BEEN CONDUCTED AT THE SITE, THE FISH AND WILDLIFE SERVICE HAS RECOMMENDED THAT THE CONTAMINATED SPRING FLOWING INTO THE CREEK BE REMEDIATED AND AN ECOLOGICAL CONTAMINANT MONITORING PROGRAM BE INCLUDED IN THE SELECTED REMEDY. THE PROGRAM WOULD ALSO INCLUDE MONITORING OF BRUSHY FORK CREEK FOR INCREASES IN WATER COLUMN AND SEDIMENT CONTAMINATION.

#DOA

7.0 DESCRIPTION OF ALTERNATIVES

7.1 BACKGROUND

FEASIBILITY STUDY (FS) WAS CONDUCTED TO DEVELOP AND EVALUATE REMEDIAL ALTERNATIVES FOR OPERABLE UNIT #1 AT THE TRI-CITY SITE. REMEDIAL ALTERNATIVES WERE ASSEMBLED FROM APPLICABLE REMEDIAL TECHNOLOGY PROCESS OPTIONS AND WERE INITIALLY EVALUATED FOR EFFECTIVENESS, IMPLEMENTABILITY, AND COST. THE ALTERNATIVES MEETING THESE CRITERIA WERE THEN EVALUATED AND COMPARED TO THE NINE CRITERIA REQUIRED BY THE NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN (NCP). IN ADDITION TO THE REMEDIAL ALTERNATIVES, THE NCP REQUIRES THAT A NO-ACTION ALTERNATIVE BE CONSIDERED AT EVERY SUPERFUND SITE. THE NO-ACTION ALTERNATIVE SERVES PRIMARILY AS A POINT OF COMPARISON FOR OTHER ALTERNATIVES.

THE REMEDIAL ALTERNATIVES PROPOSED FOR THE TRI-CITY SITE WERE DEVELOPED TO PRIMARILY ADDRESS CONTAMINATED GROUNDWATER AS IT DISCHARGES TO THE SPRINGS. TREATMENT TECHNOLOGIES THAT REQUIRE THE GROUNDWATER TO BE BROUGHT TO THE SURFACE FOR TREATMENT USING AN EXTRACTION SYSTEM WERE CONSIDERED. HOWEVER, THE EFFECTIVENESS OF A PUMPING WELL SYSTEM WOULD DEPEND ON THE ABILITY OF THE INDIVIDUAL WELLS TO INTERSECT FRACTURES WITHIN THE BEDROCK. ONLY SIX OF THE THIRTEEN GROUNDWATER MONITORING WELLS ATTEMPTED AT THE SITE PRODUCED SUFFICIENT WATER FOR COMPLETION, AND ONLY ONE WELL (MW-08) HAD SUFFICIENT YIELD TO BE CONSIDERED FOR EXTRACTION PURPOSES. CONSEQUENTLY, A HIGH DEGREE OF UNCERTAINTY IS ASSOCIATED WITH ATTEMPTING TO CAPTURE CONTAMINATED GROUNDWATER WITHIN THE VARIABLY FRACTURED ROCK MASS. MOREOVER, THE EXISTENCE OF A WIDESPREAD, WELL-DEFINED VOLATILE ORGANIC CONTAMINANT PLUME WAS NOT SUBSTANTIATED BY THE ANALYTICAL RESULTS FROM THE RI.

AT THE TRI-CITY SITE, GROUNDWATER DISCHARGES TO THE SURFACE AS SPRINGS. THE LEVELS OF VOLATILE ORGANIC CONTAMINANTS HAVE APPARENTLY DECREASED IN THE KLAPPER AND CATTLE SPRINGS, AND ONLY THE COX SPRING CURRENTLY CONTAINS VOC LEVELS IN EXCESS OF MCLS AND NON-ZERO MCLGS. IT IS BELIEVED THAT THE PRIMARY SOURCE OF THE GROUNDWATER CONTAMINATION WAS REMOVED DURING THE EMERGENCY REMOVAL ACTION CONDUCTED BY EPA IN AUGUST AND SEPTEMBER 1988. CONFIRMATORY SAMPLING IN THE AREA OF THE REMOVAL ACTION IS NECESSARY TO DETERMINE IF THIS SOURCE WAS COMPLETELY REMOVED.

7.2 REMEDIAL ALTERNATIVES

A TOTAL OF FOUR ALTERNATIVES WERE EVALUATED IN DETAIL TO ADDRESS OPERABLE UNIT #1 AT THE TRI-CITY SITE. EXCEPT FOR THE NO-ACTION ALTERNATIVE, EACH ALTERNATIVE INCLUDES THE FOLLOWING COMMON ELEMENTS:

(1) INSTITUTIONAL CONTROLS. INTERIM ACTIONS THAT INCLUDE RESTRICTIONS ON THE POTABLE USE OF GROUNDWATER CONTAINING, OR POTENTIALLY CONTAINING, LEVELS OF CONTAMINATION IN EXCESS OF MCLS OR NON-ZERO MCLGS WOULD BE IMPLEMENTED. THESE SPRINGS INCLUDE THE COX SPRING, THE KLAPPER SPRING, THE CATTLE SPRING, THE GRADING SPRING #1, AND THE UNNAMED SPRING. THE RESTRICTIONS MAY INCLUDE LOCAL ORDINANCES, CONSERVATION OR RESTRICTIVE EASEMENTS, RECORD NOTICE OR SOME OTHER APPROPRIATE MEASURE. POTABLE WATER WOULD CONTINUE BEING PROVIDED TO RESIDENTS WHO PREVIOUSLY USED THE CONTAMINATED SPRINGS AS SOURCES OF POTABLE WATER. THE RESTRICTIONS AND THE PROVISION OF POTABLE WATER TO AFFECTED RESIDENTS WOULD CONTINUE UNTIL EPA, THROUGH MONITORING, DETERMINES THAT THE WATER IS OF SUFFICIENT AND CONSISTENT QUALITY FOR HUMAN CONSUMPTION.

(2) LONG-TERM MONITORING. SINCE THE ON-SITE SPRINGS HAVE BEEN HISTORICALLY USED AS SOURCES OF POTABLE WATER, LONG-TERM MONITORING IS PROPOSED TO ENSURE THAT CONTAMINANT LEVELS REMAIN BELOW MCLS AND NON-ZERO MCLGS. FIVE OF THE ON-SITE SPRINGS (COX, KLAPPER, GRADING #2, CATTLE, AND THE UNNAMED SPRING) WOULD BE MONITORED QUARTERLY FOR THE FIRST YEAR TO IDENTIFY SEASONAL VARIATIONS IN CONTAMINANT LEVELS, SEMI-ANNUALLY FOR THE NEXT TWO YEARS, AND YEARLY THEREAFTER FOR UP TO 27 YEARS. IN ADDITION TO CONTINUOUS REVIEWS FOR ANY PUBLIC HEALTH CONCERNS, THE DATA FROM THE SPRING SAMPLING WOULD BE REVIEWED TO IDENTIFY CONTAMINANT LEVELS THAT WARRANT REMEDIAL ACTION. IF TREATMENT OF ANY OF THE OTHER ON-SITE SPRINGS, IN ADDITION TO THE COX SPRING, IS DETERMINED TO BE NECESSARY, IT WILL BE INCLUDED IN OPERABLE UNIT #1.

THE GROUNDWATER WOULD ALSO BE MONITORED FOR UP TO 30 YEARS VIA ANNUAL SAMPLING OF THE EXISTING WELLS. THE SURFACE WATER AND SEDIMENT OF BRUSHY FORK CREEK WOULD BE MONITORED VIA ANNUAL SAMPLING FOR UP TO 30 YEARS. THE SAMPLING RESULTS WOULD BE REVIEWED EVERY FIVE YEARS FOR POSSIBLE ALTERATIONS IN THE MONITORING PROGRAM.

AN ECOLOGICAL CONTAMINANT MONITORING PROGRAM INVOLVING BIOASSAY AND TISSUE ANALYSES WOULD BE CONDUCTED AT THE SITE. THIS PROGRAM WOULD CONSIST OF THREE MONITORING EPISODES OVER THE FIVE-YEAR PERIOD FOLLOWING IMPLEMENTATION OF THE REMEDY. THE INITIAL MONITORING EPISODE WOULD BE CONDUCTED CONCURRENTLY WITH THE CONFIRMATORY SAMPLING DURING THE RD PHASE TO ESTABLISH BASELINE CONDITIONS. THE SECOND MONITORING EPISODE WOULD BE CONDUCTED ONE YEAR LATER TO IDENTIFY ANY SHORT-TERM SITE-RELATED IMPACTS. THE THIRD MONITORING EPISODE WOULD BE CONDUCTED FIVE YEARS AFTER IMPLEMENTATION OF THE REMEDY TO IDENTIFY ANY LONG-TERM SITE-RELATED IMPACTS. THE MONITORING EPISODES WOULD ALSO BE CONDUCTED DURING DIFFERENT SEASONS TO BE REPRESENTATIVE OF SITE CONDITIONS. IF THE MONITORING EPISODES INDICATE THAT SITE-RELATED ECOLOGICAL DEGRADATION HAS OCCURRED (OR IS OCCURRING), HISTOPATHOLOGICAL STUDIES MAY BE NECESSARY TO FURTHER DEFINE THE IMPACT. THE ADDITIONAL MEASURES NECESSARY TO MITIGATE THE THREAT TO THE ENVIRONMENT WOULD BE IMPLEMENTED IN OPERABLE UNIT 42.

(3) CONFIRMATORY SAMPLING. CONFIRMATORY SAMPLING WOULD BE CONDUCTED CONDUCTED TO ASSESS THE EFFECTIVENESS OF THE EMERGENCY REMOVAL ACTION CONDUCTED NEAR THE COX, SR. RESIDENCE. THE APPARENTLY DISTURBED AREAS IN THE NORTHERN PORTION OF THE SITE (AS SHOWN IN THE EPIC AERIAL PHOTOGRAPH TAKEN IN 1967) WOULD BE ALSO SAMPLED TO INVESTIGATE POSSIBLE CONTAMINATION FROM DRUM DISPOSAL.

THE SURFACE SOILS ALONG THE EASTERN EDGE OF THE FORMER DISPOSAL AREA WHERE THE PASS AND ONE SPECIES OF PCB WERE FOUND DURING THE RI WOULD BE SAMPLED TO ESTABLISH THE EXTENT OF ANY PAH AND PCB CONTAMINATION.

THE SEDIMENT IN THE TRIBUTARY TO BRUSHY FORK CREEK WHERE THE SAMPLE CONTAINING LEVELS OF CHROMIUM AND LEAD SUBSTANTIALLY ABOVE THE ER-L VALUES WAS COLLECTED DURING THE RI AND EXTENDING TO THE LOCATION OF THE DOWNSTREAM SAMPLE CONTAINING THE LEAD LEVEL IN EXCESS OF THE ER-L VALUE WOULD BE SAMPLED TO DETERMINE THE EXTENT OF THE CONTAMINATION. ADDITIONAL AIR SAMPLING ALONG THE SLOPE OF THE COX LOBE WOULD BE CONDUCTED TO IDENTIFY THE SOURCE OF THE PCE DETECTED DURING THE RI.

THE REMEDIAL ALTERNATIVES ARE DESCRIBED IN THE FOLLOWING DISCUSSIONS.

ALTERNATIVE 1 - NO ACTION

UNDER THIS ALTERNATIVE, EPA WOULD TAKE NO FURTHER ACTION AND THE SITE WOULD BE LEFT "AS IS". THIS ALTERNATIVE RELIES ON FLUSHING OF THE GROUNDWATER VIA THE SPRINGS TO NATURALLY REMOVE THE VOLATILE ORGANIC CONTAMINATION AND RESTORE THE GROUNDWATER TO A CLASS 11-8 AQUIFER SUITABLE FOR DRINKING WATER PURPOSES.

IT IS EXPECTED THAT THE VOC LEVELS IN THE COX SPRING WILL DECREASE TO NEAR OR BELOW MCLS AND NON-ZERO MCLGS WITHIN TEN YEARS. THIS CONCLUSION IS BASED ON THE FOLLOWING CONSIDERATIONS: (1) THE SOIL CONTAMINATION THAT CONSTITUTED THE PRIMARY SOURCE OF GROUNDWATER CONTAMINATION HAS BEEN REMOVED; (2) THE VOCS OF CONCERN IN THE AQUIFER ARE HIGHLY MOBILE AND RAPIDLY FLUSHED FROM THE AQUIFER; (3) THE CONTAMINANTS WILL FLUSH FROM THE SOLUTIONALLY ENLARGED FRACTURES OF THE LIMESTONE AQUIFER MORE RAPIDLY THAN IF THE AQUIFER WERE COMPOSED OF A POROUS MEDIUM SUCH AS SAND OR CLAY; AND (4) INFILTRATING PRECIPITATION WILL CAUSE DILUTION OF CONTAMINANTS IN THE AQUIFER. MOREOVER, THE VOC LEVELS IN SEVERAL SPRINGS APPEAR TO BE DECREASING. THIS TREND WILL BE VERIFIED BY LONG-TERM MONITORING.

THIS ALTERNATIVE WOULD NOT REDUCE THE RISK ASSOCIATED WITH THE POTENTIAL POTABLE USE OF CONTAMINATED SPRING WATER AND GROUNDWATER. MOREOVER, ANY RISKS FROM POTENTIALLY CONTAMINATED SITE SOILS, SEDIMENT, AND AMBIENT AIR WOULD NOT BE INVESTIGATED.

NO FUNDS WOULD BE SPENT FOR THIS ALTERNATIVE AND IT COULD BE IMPLEMENTED IMMEDIATELY. HOWEVER, SINCE THIS ALTERNATIVE WOULD RESULT IN CONTAMINATION REMAINING ON-SITE, CERCLA REQUIRES THAT THE SITE BE REVIEWED EVERY FIVE YEARS. IF INDICATED BY THE REVIEW, REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO MITIGATE ANY THREAT TO HUMAN HEALTH OR THE ENVIRONMENT.

ALTERNATIVE 2 - LIMITED ACTION

THIS ALTERNATIVE INCLUDES THE THREE MAJOR COMPONENTS PREVIOUSLY DISCUSSED: INSTITUTIONAL CONTROLS, LONG-TERM MONITORING, AND CONFIRMATORY SAMPLING. INSTITUTIONAL CONTROLS WOULD BE NECESSARY UNTIL NATURAL PROCESSES RESTORE THE GROUNDWATER TO A CLASS 11-8 AQUIFER SUITABLE FOR DRINKING WATER PURPOSES. AS DESCRIBED IN THE NO-ACTION ALTERNATIVE, IT IS EXPECTED THAT THE VOC LEVELS IN THE COX SPRING WILL DECREASE TO NEAR OR BELOW MCLS AND NON-ZERO MCLGS WITHIN TEN YEARS.

SINCE THIS ALTERNATIVE DOES NOT INCLUDE TREATMENT OF THE CONTAMINATED SPRING WATER, IT DOES NOT REDUCE THE RISK ASSOCIATED WITH POTENTIAL POTABLE USAGE.

THE TOTAL PRESENT WORTH OF THIS ALTERNATIVE FOR A 30-YEAR PERIOD IS APPROXIMATELY $1,714,000 AND THE CAPITAL COST IS ESTIMATED TO BE $880,798. THE ANNUAL OPERATION AND MAINTENANCE COSTS ARE SHOWN IN TABLE 19. THIS ALTERNATIVE COULD BE IMPLEMENTED IN APPROXIMATELY 12 MONTHS.

SINCE THIS ALTERNATIVE WOULD RESULT IN CONTAMINATION REMAINING ON-SITE, CERCLA REQUIRES THAT THE SITE BE REVIEWED EVERY FIVE YEARS. IF INDICATED BY THE REVIEW, REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO MITIGATE ANY THREAT TO HUMAN HEALTH OR THE ENVIRONMENT.

ALTERNATIVE 3 - CARBON ADSORPTION

THIS ALTERNATIVE INCLUDES THE THREE MAJOR COMPONENTS PREVIOUSLY DESCRIBED AND TREATMENT OF CONTAMINATED SPRING WATER IN A CARBON ADSORPTION SYSTEM. A TREATMENT SYSTEM WOULD BE INSTALLED ONLY AT THE COX SPRING, UNLESS MONITORING INDICATED THAT CONTAMINATION IN OTHER SPRINGS EXCEEDED MCLS OR NON-ZERO MCLGS. THE TREATMENT SYSTEM WOULD CONSIST OF MODIFICATIONS TO THE EXISTING CISTERN AND PIPING TO A DISPOSABLE ACTIVATED CARBON CANISTER. THE CISTERN WILL EQUALIZE THE CONTAMINANT CONCENTRATIONS AND A SAND/GEOTEXTILE FILTER WILL COLLECT ANY LARGE PARTICULATES IN THE SPRING WATER. THE SPRING WATER WOULD THEN FLOW TO THE CARBON CANISTER BY GRAVITY.

REMEDIATION OF CONTAMINATED GROUNDWATER FOR A CLASS IIB AQUIFER IS REQUIRED TO MEET MCLS AS ESTABLISHED UNDER THE SAFE DRINKING WATER ACT (40 CFR PART 141) AND TO ATTAIN NON-ZERO MCLGS. THE MCLS AND NON-ZERO MCLGS FOR THE CONTAMINANTS OF CONCERN IN THE COX SPRING ARE IDENTIFIED IN TABLE 20. REDUCTION OF THE CONTAMINANTS TO THESE LEVELS WOULD REDUCE THE CARCINOGENIC RISK ASSOCIATED WITH THE INGESTION OF CONTAMINATED WATER TO 1.4E-4 AND THE HAZARD INDEX TO LESS THAN ONE (1) FOR A 70 KILOGRAM (KG) ADULT OVER A 70-YEAR LIFETIME. THESE LEVELS ARE WITHIN EPA'S ACCEPTABLE RISK RANGE OF E-4 TO E-6 AND A HAZARD INDEX OF LESS THAN ONE (1).

THE TREATED WATER WOULD BE DISCHARGED TO THE TRIBUTARIES DOWNSTREAM OF THE SPRINGS. ANY DISCHARGE TO A NEARBY SURFACE WATER BODY IS REQUIRED TO MEET NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STANDARDS ESTABLISHED BY THE CLEAN WATER ACT AND REGULATED BY THE COMMONWEALTH OF KENTUCKY. THE STATE SURFACE WATER STANDARDS, 401 KAR 5:031, ARE INCLUDED AS APPENDIX A OF THIS DOCUMENT. FINAL DISCHARGE LEVELS WILL BE DETERMINED BY SURFACE WATER FLOW INFORMATION, CONTAMINANT LEVELS, AND WATER QUALITY TESTING THAT WILL BE ESTABLISHED BY THE COMMONWEALTH OF KENTUCKY. THE SURFACE WATER DISCHARGE WILL BE REQUIRED TO MEET THE NPDES LIMITS THAT ARE ESTABLISHED.

TREATMENT OF CONTAMINATED SPRING WATER WILL CONTINUE UNTIL CONTAMINANT LEVELS IN THE INFLUENT (I.E., THE GROUNDWATER DISCHARGING TO THE SURFACE AS A SPRING) DECREASE TO BELOW MCLS AND NON-ZERO MCLGS BY NATURAL PROCESSES. AS DESCRIBED IN THE NO-ACTION ALTERNATIVE, THE VOC LEVELS IN THE COX SPRING ARE EXPECTED TO DECREASE TO NEAR OR BELOW MCLS AND NON-ZERO MCLGS WITHIN TEN YEARS.

MONTHLY MONITORING OF THE INFLUENT AND EFFLUENT WOULD BE REQUIRED FOR THE FIRST YEAR TO DETERMINE THE FREQUENCY OF CARBON REPLACEMENT. FOR UP TO THE FOLLOWING 29 YEARS, THE INFLUENT AND EFFLUENT WOULD BE SAMPLED PRIOR TO CARBON REPLACEMENT.

THE SPENT CARBON WOULD BE REGENERATED OR TREATED/DISPOSED OFF-SITE, SO ANALYSIS OF THE SPENT CARBON WOULD BE CONDUCTED USING THE TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) TO DETERMINE IF IT IS A HAZARDOUS WASTE. THIS ANALYSIS IS NECESSARY TO ENSURE THAT APPLICABLE SUBTITLE C OR D REQUIREMENTS OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) ARE MET.

THE TOTAL PRESENT WORTH OF ALTERNATIVE 3 OVER A 30-YEAR PERIOD IS APPROXIMATELY $2,098,000 WITH A CAPITAL COST OF $904,254. THE ANNUAL OPERATION AND MAINTENANCE COSTS ARE SHOWN IN TABLE 19. THE TIME REQUIRED TO IMPLEMENT THIS ALTERNATIVE IS EXPECTED TO BE 14 MONTHS, WHICH INCLUDES 12 MONTHS FOR REMEDIAL DESIGN AND PROCUREMENTS AND TWO MONTHS FOR CONSTRUCTION.

SINCE THIS ALTERNATIVE WOULD RESULT IN CONTAMINATION REMAINING ON-SITE, CERCLA REQUIRES THAT THE SITE BE REVIEWED EVERY FIVE YEARS. IF INDICATED BY THE REVIEW, REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO MITIGATE ANY THREAT TO HUMAN HEALTH OR THE ENVIRONMENT.

ALTERNATIVE 4 - AERATION.

THIS ALTERNATIVE ALSO INCLUDES THE THREE MAJOR COMPONENTS PREVIOUSLY DESCRIBED AND TREATMENT OF THE CONTAMINATED SPRING WATER BY AERATION. A TREATMENT SYSTEM WOULD BE INSTALLED ONLY AT THE COX SPRING, UNLESS MONITORING INDICATED THAT CONTAMINATION IN OTHER SPRINGS EXCEEDED MCLS OR NON-ZERO MCLGS. THE AERATION TREATMENT PROCESS WOULD INVOLVE THE CONSTRUCTION OF A SERIES OF APPROXIMATELY THIRTY CONCRETE STEPS OVER WHICH THE SPRING WATER WOULD PASS. SPRING WATER WOULD FLOW INTO AND THROUGH THE AERATION ZONE BY GRAVITY. THE SERIES OF STEPS WOULD INCREASE THE MIXING OF THE SPRING WATER WITH AIR, THEREBY PROMOTING THE EVAPORATION OF THE VOCS FROM THE WATER.

AS IN ALTERNATIVE 3, REMEDIATION OF CONTAMINATED GROUNDWATER FOR A CLASS 11B AQUIFER IS REQUIRED TO MEET MCLS AS ESTABLISHED UNDER THE SAFE DRINKING WATER ACT (40 CFR PART 141) AND TO ATTAIN NON-ZERO MCLGS. THE MCLS AND MCLGS FOR THE CONTAMINANTS OF CONCERN IN THE COX SPRING WERE IDENTIFIED IN TABLE 20.

TREATMENT OF CONTAMINATED SPRING WATER WILL CONTINUE UNTIL CONTAMINANT LEVELS IN THE INFLUENT (I.E., THE GROUNDWATER DISCHARGING TO THE SURFACE AS A SPRING) DECREASES TO BELOW MCLS AND NON-ZERO MCLGS BY NATURAL PROCESSES. AS DESCRIBED IN THE NO-ACTION ALTERNATIVE, THE VOC LEVELS IN THE COX SPRING ARE EXPECTED TO DECREASE TO NEAR OR BELOW MCLS AND NON-ZERO MCLGS WITHIN TEN YEARS.

THE TREATED WATER WOULD BE DISCHARGED TO THE TRIBUTARIES DOWNSTREAM OF THE SPRINGS. AS DESCRIBED IN ALTERNATIVE 3, ANY DISCHARGE TO A NEARBY SURFACE WATER BODY IS REQUIRED TO MEET THE NPDES STANDARDS ESTABLISHED BY THE CLEAN WATER ACT AND REGULATED BY THE COMMONWEALTH OF KENTUCKY. FINAL DISCHARGE LEVELS WILL BE DETERMINED BY SURFACE WATER FLOW INFORMATION, CONTAMINANT LEVELS, AND WATER QUALITY TESTING THAT WILL BE ESTABLISHED BY THE COMMONWEALTH OF KENTUCKY. THE SURFACE WATER DISCHARGE WILL BE REQUIRED TO MEET THE NPDES LIMITS THAT ARE ESTABLISHED.

A TREATABILITY STUDY WOULD BE REQUIRED TO DETERMINE THE DESIGN PARAMETERS OF THE AERATION SYSTEM PRIOR TO CONSTRUCTION. THE INFLUENT AND EFFLUENT WOULD BE MONITORED MONTHLY FOR THE FIRST YEAR AND ANNUALLY FOR UP TO THE NEXT 29 YEARS IF THE SYSTEM IS EFFECTIVE. THIS TREATMENT PROCESS DOES NOT GENERATE ANY TREATMENT RESIDUES OTHER THAN AIR EMISSIONS. THE TREATABILITY STUDY WOULD INCLUDE AN EVALUATION OF THE AIR EMISSIONS TO DETERMINE IF TREATMENT WOULD BE NECESSARY. RELEASES FROM THE AERATION ZONE WILL COMPLY WITH THE CLEAN AIR ACT AS ENFORCED THROUGH FEDERAL AND STATE STANDARDS.

THE TOTAL PRESENT WORTH OF THIS ALTERNATIVE FOR A 30-YEAR PERIOD IS APPROXIMATELY $1,990,000 AND THE CAPITAL COST IS ESTIMATED AT $1,080,743. THE ANNUAL OPERATION AND MAINTENANCE COSTS ARE SHOWN IN TABLE 19. THE TIME REQUIRED TO IMPLEMENT THIS ALTERNATIVE IS EXPECTED TO BE 13 MONTHS, WHICH INCLUDES 12 MONTHS FOR REMEDIAL DESIGN AND PROCUREMENTS AND ONE MONTH FOR CONSTRUCTION.

SINCE THIS ALTERNATIVE WOULD RESULT IN CONTAMINATION REMAINING ON-SITE, CERCLA REQUIRES THAT THE SITE BE REVIEWED EVERY FIVE YEARS. IF INDICATED BY THE REVIEW, REMEDIAL ACTIONS WOULD BE IMPLEMENTED AT THAT TIME TO MITIGATE ANY THREAT TO HUMAN HEALTH OR THE ENVIRONMENT.

7.3 ARARS

THE REMEDY IMPLEMENTED FOR OPERABLE UNIT #1 WILL MEET THE PERFORMANCE STANDARDS DESCRIBED BELOW, WHICH ARE THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) IDENTIFIED FOR THE PROPOSED ALTERNATIVES.

REMEDIATION OF CONTAMINATED GROUNDWATER FOR A CLASS IIB AQUIFER IS REQUIRED TO MEET MCLS AS

ESTABLISHED UNDER THE SAFE DRINKING WATER ACT (40 CFR PART 141) AND TO ATTAIN NON-ZERO MCLGS. THE MCLS AND MCLGS FOR THE CONTAMINANTS OF CONCERN AT THE SITE WERE IDENTIFIED IN TABLE 20. REDUCTION OF THE CONTAMINANTS TO THESE LEVELS WILL REDUCE THE RISK ASSOCIATED WITH THE INGESTION OF CONTAMINATED GROUNDWATER TO 1.4E-4 FOR A 70 KG ADULT OVER A 70-YEAR LIFETIME. THIS RISK FALLS WITHIN EPA'S ACCEPTABLE RISK RANGE OF E-4 TO E-6.

ANY DISCHARGE TO A NEARBY SURFACE WATER BODY IS REQUIRED TO MEET NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STANDARDS ESTABLISHED BY THE CLEAN WATER ACT AND REGULATED BY THE COMMONWEALTH OF KENTUCKY. THE STATE SURFACE WATER STANDARDS, 401 KAR 5:031, ARE INCLUDED AS APPENDIX A OF THIS DOCUMENT. FINAL DISCHARGE LEVELS WILL BE DETERMINED BY SURFACE WATER FLOW INFORMATION, CONTAMINANT LEVELS, AND WATER QUALITY TESTING THAT WILL BE ESTABLISHED BY THE COMMONWEALTH OF KENTUCKY. THE SURFACE WATER DISCHARGE WILL BE REQUIRED TO MEET THE NPDES LIMITS THAT ARE ESTABLISHED.

THE CLEAN AIR ACT IS AN ARAR FOR THE RELEASES TO AIR FROM THE TREATMENT SYSTEMS INCLUDED IN ALTERNATIVES 3 AND 4. RELEASES FROM THESE SYSTEMS WOULD COMPLY WITH FEDERAL AND STATE STANDARDS PROMULGATED UNDER THE CLEAN AIR ACT.

THE SPENT CARBON FROM THE CARBON ADSORPTION TREATMENT SYSTEM IN ALTERNATIVE 3 WOULD BE REGENERATED OR TREATED/DISPOSED OFF-SITE, SO ANALYSIS OF THE SPENT CARBON WOULD BE CONDUCTED USING THE TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) (40 CFR PART 262, APPENDIX 11) TO DETERMINE IF IT IS A HAZARDOUS WASTE. THIS ANALYSIS IS NECESSARY TO ENSURE THAT APPLICABLE SUBTITLE C OR D REQUIREMENTS OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) ARE MET. IF THE SPENT CARBON IS DETERMINED TO BE A HAZARDOUS WASTE BASED ON THE RESULTS OF THE TCLP AND IF REGENERATION IS NOT TECHNICALLY FEASIBLE, IT WOULD NOT BE LAND DISPOSED UNLESS THE TREATMENT STANDARDS FOR ALL APPLICABLE TCLP CONSTITUENTS ARE MET (40 CFR PART 268).

PURSUANT TO THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (OSEA), HEALTH AND SAFETY STANDARDS FOR EMPLOYEES ENGAGED IN HAZARDOUS WASTE OPERATIONS WERE EFFECTIVE ON MARCH 6, 1990 (54 FR 9294). CONSEQUENTLY, A WORKER HEALTH AND SAFETY PROGRAM THAT COMPLIES WITH OSHA STANDARDS IS REQUIRED FOR THE REMEDIAL ACTIVITIES TO BE CONDUCTED ON-SITE.

#SCAA

8.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

DURING THE FEASIBILITY STUDY, A DETAILED ANALYSIS OF EACH ALTERNATIVE WAS PERFORMED USING THE NINE EVALUATION CRITERIA IDENTIFIED IN THE NCP. THE ADVANTAGES AND DISADVANTAGES OF EACH ALTERNATIVE WERE THEN COMPARED TO IDENTIFY THE ALTERNATIVE PROVIDING THE BEST BALANCE OF THE NINE CRITERIA. THE FOLLOWING DISCUSSIONS SUMMARIZE THE COMPARATIVE ANALYSIS.

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT ADDRESSES THE DEGREE TO WHICH THE ALTERNATIVE ELIMINATES, REDUCES, OR CONTROLS THREATS TO PUBLIC HEALTH AND THE ENVIRONMENT THROUGH TREATMENT, ENGINEERING METHODS, OR INSTITUTIONAL CONTROLS.

THE PRESENT AND FUTURE RISKS TO HUMAN HEALTH AND THE ENVIRONMENT FROM EXPOSURE TO CONTAMINATED GROUNDWATER (PRIMARILY AS IT DISCHARGES TO THE SURFACE AS SPRINGS) WOULD BE UNCHANGED IF ALTERNATIVE 1 WAS IMPLEMENTED. ALTHOUGH IT IS ANTICIPATED THAT CONTAMINANT CONCENTRATIONS WILL EVENTUALLY DECREASE AS A RESULT OF NATURAL DEGRADATION AND FLUSHING, THE VOCS IN THE SPRING WATER ARE CURRENTLY VOLATILIZING INTO THE ATMOSPHERE THROUGH NATURAL MIXING IN THE STREAM BED. THE IMPACT ON DOWNGRADIENT SURFACE WATER BODIES HAS BEEN DETERMINED TO BE MINIMAL. IN ADDITION, ANY RISKS FROM POTENTIALLY CONTAMINATED SITE SOILS, SEDIMENT, AND AMBIENT AIR WOULD NOT BE

INVESTIGATED.

ALTERNATIVE 2 INCLUDES INSTITUTIONAL CONTROLS TO RESTRICT RESIDENTS FROM USING GROUNDWATER AND SPRING WATER FOR DOMESTIC PURPOSES, AND IT PROVIDES FOR POTABLE WATER TO AFFECTED RESIDENTS. CONSEQUENTLY, THE POTENTIAL RISKS TO HUMAN HEALTH FROM THE USE OF CONTAMINATED GROUNDWATER AND SPRING WATER WOULD BE REDUCED. ANY RISKS ASSOCIATED WITH POTENTIALLY CONTAMINATED SITE SOILS, SEDIMENT, AND AMBIENT AIR WOULD ALSO BE INVESTIGATED IN THE ALTERNATIVE SO IT IS MORE PROTECTIVE THAN ALTERNATIVE 1. HOWEVER, NEITHER ALTERNATIVE INCLUDES TREATMENT OF GROUND WATER TO MCLS AND NON-ZERO MCLGS, AND VOCS WILL CONTINUE TO VOLATILIZE INTO THE ATMOSPHERE.

ALTERNATIVE 3 WOULD PROVIDE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. INSTITUTIONAL CONTROLS, PROVISION OF POTABLE WATER TO AFFECTED RESIDENTS, AND GROUNDWATER TREATMENT WOULD REDUCE THE POTENTIAL RISK TO HUMAN HEALTH FROM INGESTION AND OTHER HOUSEHOLD USES. GROUNDWATER TREATMENT WOULD ALSO REDUCE ANY ENVIRONMENTAL IMPACTS BY PREVENTING THE SPREAD OF CONTAMINANTS TO BRUSHY FORK CREEK AND THE ATMOSPHERE. CONTAMINANT LEVELS IN THE GROUNDWATER WOULD BE REDUCED TO LEVELS IN CONFORMANCE WITH ARARS. MOREOVER, ANY RISKS ASSOCIATED WITH POTENTIALLY CONTAMINATED SITE SOILS, SEDIMENT, AND AMBIENT AIR WOULD ALSO BE INVESTIGATED IN THIS ALTERNATIVE.

ALTERNATIVE 4 WOULD BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. HOWEVER, THE PROPOSED AERATION SYSTEM IS INNOVATIVE AND A TREATABILITY STUDY WOULD BE NECESSARY TO DETERMINE IF AIR EMISSION CONTROLS ARE REQUIRED. THE POTENTIAL RISK TO HUMAN HEALTH FROM INGESTION OF CONTAMINATED GROUND WATER AND OTHER HOUSEHOLD USES WOULD BE REDUCED BY INSTITUTIONAL CONTROLS, PROVISION OF POTABLE WATER TO AFFECTED RESIDENTS, AND GROUNDWATER TREATMENT TO LEVELS IN CONFORMANCE WITH ARARS. GROUNDWATER TREATMENT WOULD ALSO REDUCE ANY ENVIRONMENTAL IMPACTS BY PREVENTING THE SPREAD OF CONTAMINANTS TO BRUSHY FORK CREEK. AS IN ALTERNATIVES 2 AND 3, ANY RISKS ASSOCIATED WITH POTENTIALLY CONTAMINATED SITE SOILS, SEDIMENT, AND AMBIENT AIR WOULD BE INVESTIGATED IN ALTERNATIVE 4.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

APPLICABLE REQUIREMENTS ARE THOSE CLEANUP STANDARDS, STANDARDS OF CONTROL, AND OTHER SUBSTANTIVE REQUIREMENTS, CRITERIA, OR LIMITATIONS PROMULGATED UNDER FEDERAL OR STATE ENVIRONMENTAL OR FACILITY SITING LAW THAT SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE AT A CERCLA SITE. RELEVANT AND APPROPRIATE REQUIREMENTS ARE THOSE CLEANUP STANDARDS, STANDARDS OF CONTROL, AND OTHER SUBSTANTIVE REQUIREMENTS, CRITERIA, OR LIMITATIONS UNDER FEDERAL OR STATE ENVIRONMENTAL SITING LAW THAT, WHILE NOT "APPLICABLE" TO A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION LOCATION, OR OTHER CIRCUMSTANCE AT A CERCLA SITE, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THE CERCLA SITE THAT THEIR USE IS WELL SUITED TO THE PARTICULAR SITE. COMPLIANCE WITH ARARS ADDRESSES WHETHER A REMEDY WILL MEET ALL FEDERAL AND STATE ENVIRONMENTAL LAWS AND/OR PROVIDE BASIS FOR A WAIVER FROM ANY OF THESE LAWS.

EPA HAS DIVIDED ARARS INTO THE FOLLOWING THREE CATEGORIES TO FACILITATE THEIR IDENTIFICATION: CHEMICAL-SPECIFIC, LOCATION-SPECIFIC, AND ACTION-SPECIFIC.

CHEMICAL-SPECIFIC ARARS ARE USUALLY HEALTH- OR RISK-BASED NUMERICAL VALUES OR METHODOLOGIES USED TO DETERMINE ACCEPTABLE CONCENTRATIONS OF CHEMICALS THAT MAY BE FOUND IN OR DISCHARGED TO THE ENVIRONMENT.

LOCATION-SPECIFIC ARARS RESTRICT ACTIONS OR CONTAMINANT CONCENTRATIONS IN CERTAIN ENVIRONMENTALLY SENSITIVE AREAS. EXAMPLES OF AREAS REGULATED UNDER VARIOUS FEDERAL LAWS INCLUDE FLOODPLAINS, WETLANDS, AND LOCATIONS WHERE ENDANGERED SPECIES OR HISTORICALLY SIGNIFICANT CULTURAL RESOURCES ARE PRESENT. NO LOCATION-SPECIFIC ARARS APPLY TO THE TRI-CITY SITE.

ACTION-SPECIFIC ARARS ARE USUALLY TECHNOLOGY- OR ACTIVITY-BASED REQUIREMENTS OR LIMITATIONS ON ACTIONS OR CONDITIONS INVOLVING SPECIFIC SUBSTANCES.

ALTERNATIVES 1 AND 2 WOULD NOT COMPLY WITH CHEMICAL-SPECIFIC ARARS SINCE THE COX SPRING WOULD NOT BE REMEDIATED. GROUNDWATER CONTAMINANT LEVELS WOULD CONTINUE TO EXCEED MCLS AND NON-ZERO MCLGS UNTIL NATURAL DEGRADATION AND FLUSHING REDUCES THE LEVELS. THERE ARE NO ACTION-SPECIFIC ARARS FOR ALTERNATIVES 1 AND 2.

BOTH ALTERNATIVES 3 AND 4 WOULD BE IN COMPLIANCE WITH CHEMICAL-SPECIFIC ARARS. EPA HAS DETERMINED THAT THE POINT OF COMPLIANCE FOR ARARS IS WHERE THE GROUNDWATER DISCHARGES TO THE SURFACE AS SPRINGS. REMEDIATION OF THE COX SPRING (THE ONLY SPRING CURRENTLY CONTAINING CONTAMINANT LEVELS IN EXCESS OF MCLS AND NON-ZERO MCLGS) WILL BE IN CONFORMANCE WITH THE SAFE DRINKING WATER ACT AND THE TREATED DISCHARGE WILL MEET NPDES STANDARDS ESTABLISHED BY THE CLEAN WATER ACT AND REGULATED BY THE COMMONWEALTH OF KENTUCKY.

BOTH ALTERNATIVES 3 AND 4 WOULD BE IN COMPLIANCE WITH ACTION-SPECIFIC ARARS. THE SPENT CARBON GENERATED IN ALTERNATIVE 3 WOULD BE EVALUATED FOR THE TOXICITY CHARACTERISTIC TO ENSURE THAT APPLICABLE SUBTITLE C OR D REQUIREMENTS OF RCRA ARE MET. A TREATABILITY STUDY OF THE AERATION SYSTEM DESCRIBED IN ALTERNATIVE 4 WOULD BE CONDUCTED TO DETERMINE THE APPLICABILITY OF THE CLEAN AIR ACT TO EMISSIONS.

8.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

LONG-TERM EFFECTIVENESS AND PERMANENCE REFERS TO THE ABILITY OF AN ALTERNATIVE TO MAINTAIN RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THIS CRITERION INCLUDES THE CONSIDERATION OF RESIDUAL RISK AND THE ADEQUACY AND RELIABILITY OF CONTROLS.

ALTERNATIVE 1 WOULD NOT BE EFFECTIVE IN MITIGATING POTENTIAL RISKS ASSOCIATED WITH THE DOMESTIC USES OF GROUNDWATER AND FUTURE LAND USE SCENARIOS, INCLUDING EXCAVATION IN AREAS OF POTENTIAL SUBSURFACE SOIL CONTAMINATION. MOREOVER, ANY RISKS FROM POTENTIALLY CONTAMINATED SITE SOILS, SEDIMENT, AND AMBIENT AIR WOULD NOT BE INVESTIGATED. SINCE POTENTIAL RISKS ARE NOT ADDRESSED, THERE IS A LIKELIHOOD THAT FUTURE REMEDIAL ACTIONS WOULD BE NECESSARY.

ALTERNATIVE 2 WOULD MITIGATE THE HEALTH RISK THROUGH THE IMPLEMENTATION OF INSTITUTIONAL CONTROLS TO RESTRICT THE POTABLE USE OF CONTAMINATED GROUNDWATER. GROUNDWATER USE RESTRICTIONS WOULD BE EASY TO IMPLEMENT AND RELIABLE IN THE LONG-TERM IF ENFORCED BY FEDERAL, STATE, OR LOCAL AGENCIES AND COMPLIED WITH BY PROPERTY OWNERS. MOREOVER, THE PROVISION OF POTABLE WATER TO AFFECTED RESIDENTS AND LONG-TERM MONITORING OF THE GROUND WATER ARE RELIABLE METHODS TO REDUCE THE HEALTH RISK ASSOCIATED WITH CONTAMINATED WATER SUPPLIES. HOWEVER, THE CONTAMINATED GROUNDWATER WOULD NOT BE TREATED.

ALTERNATIVE 2 DOES NOT PREVENT THE MIGRATION OF CONTAMINATION TO BRUSHY FORK CREEK NOR DOES IT PROVIDE PROTECTION TO THE BIOTA. HOWEVER, ANY ADVERSE EFFECTS ON DOWNGRADIENT SURFACE WATER BODIES HAVE, TO DATE, BEEN DETERMINED TO BE MINIMAL, AND LONG-TERM MONITORING IS A RELIABLE METHOD FOR DETECTING THE MIGRATION OF CONTAMINANTS.

BOTH ALTERNATIVES 3 AND 4 PROVIDE THE HIGHEST DEGREES OF LONG-TERM EFFECTIVENESS AND PERMANENCE BECAUSE BOTH ALTERNATIVES USE IRREVERSIBLE TREATMENT TECHNOLOGIES TO REDUCE THE HAZARDS ASSOCIATED WITH VOCS IN SPRING WATER. ALTERNATIVE 3 UTILIZES A PROVEN AND WIDELY AVAILABLE TECHNOLOGY. HOWEVER, THE SPENT CARBON FILTERS WOULD REQUIRE REGENERATION OR TREATMENT AND DISPOSAL AT AN APPROVED FACILITY. THE AERATION SYSTEM DESCRIBED IN ALTERNATIVE 4 IS INNOVATIVE, AND A TREATABILITY STUDY WOULD BE REQUIRED TO DETERMINE THE DESIGN PARAMETERS. MOREOVER, THE TREATABILITY STUDY WOULD BE USED TO QUANTIFY THE AIR EMISSIONS FROM THE ZONE OF AERATION AND TO DETERMINE IF CONTROL MEASURES ARE NECESSARY. BOTH ALTERNATIVES 3 AND 4 INCLUDE LONG-TERM

MONITORING AND CONFIRMATORY SAMPLING, WHICH ARE EFFECTIVE METHODS OF IDENTIFYING ANY ADDITIONAL HUMAN HEALTH OR ENVIRONMENTAL RISKS ASSOCIATED WITH THE SITE.

8.4 REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME REFERS TO THE PREFERENCE FOR A REMEDY THAT USES TREATMENT TO REDUCE HEALTH HAZARDS, CONTAMINANT MIGRATION, OR THE QUANTITY OF CONTAMINANTS AT THE SITE.

ALTERNATIVES 1 AND 2 DO NOT INCLUDE TREATMENT AND WOULD NOT REDUCE THE TOXICITY, MOBILITY, OR VOLUME OF THE CONTAMINANTS IN THE GROUNDWATER. ALTERNATIVE 3 WOULD REDUCE THE MOBILITY OF CONTAMINANTS BY TRANSFERRING THE VOCS TO THE ACTIVATED CARBON. THE TOXICITY AND VOLUME OF THE CONTAMINANTS WOULD BE REDUCED WHEN THE SPENT ACTIVATED CARBON IS REMOVED FROM THE SITE FOR REGENERATION OR TREATMENT PRIOR TO DISPOSAL AT AN APPROVED OFF-SITE FACILITY. ALTERNATIVE 4 WOULD REDUCE THE VOLUME OF CONTAMINANTS IN THE GROUNDWATER, BUT AIR EMISSION CONTROLS WOULD BE NECESSARY TO PREVENT TRANSFER OF THE CONTAMINANTS TO THE ATMOSPHERE. THE NATURE AND QUANTITIES OF THESE CONTAMINANTS WOULD BE IDENTIFIED DURING THE TREATABILITY STUDY TO DETERMINE COMPLIANCE WITH THE APPROPRIATE AIR STANDARDS.

8.5 SHORT-TERM EFFECTIVENESS

SHORT-TERM EFFECTIVENESS ADDRESSES THE PERIOD OF TIME NEEDED TO ACHIEVE PROTECTION AND ASSESSES ANY RISKS TO HUMAN HEALTH AND THE ENVIRONMENT DURING THE CONSTRUCTION AND IMPLEMENTATION PERIOD UNTIL CLEANUP OBJECTIVES ARE ACHIEVED.

THERE WOULD BE NO SHORT-TERM RISK TO THE COMMUNITY AND THE ENVIRONMENT IF ALTERNATIVE 1 WAS IMPLEMENTED BECAUSE NO WORK WOULD BE PERFORMED. AND THOUGH THE INSTITUTIONAL CONTROLS INCLUDED IN ALTERNATIVE 2 WOULD NOT RESULT IN SHORT-TERM RISKS TO THE COMMUNITY, WORKERS WOULD NEED PROTECTIVE CLOTHING DURING FIELD SAMPLING ACTIVITIES TO AVOID CONTACT WITH CONTAMINANTS.

ALTERNATIVES 3 AND 4 REQUIRE INSTALLATION OF TREATMENT SYSTEMS ON-SITE, IN ADDITION TO IMPLEMENTING THE LONG-TERM MONITORING AND CONFIRMATORY SAMPLING PROGRAMS. BOTH ALTERNATIVES REQUIRED VERY LIMITED CONSTRUCTION THAT WOULD RESULT IN MINIMAL IMPACT ON THE ON-SITE RESIDENTS. MONITORING WOULD BE PERFORMED DURING CONSTRUCTION TO ENSURE PROTECTION OF THE ON-SITE RESIDENTS AND WORKERS. PROTECTIVE EQUIPMENT WOULD ALSO BE USED BY WORKERS WHO MIGHT COME IN CONTACT WITH CONTAMINATED GROUNDWATER. IMPACT TO THE CREEK WOULD ALSO BE MINIMAL SINCE THE CONSTRUCTION WOULD BE CONFINED TO A SMALL AREA.

CONSTRUCTION TIME PERIODS ARE ANTICIPATED TO BE SHORT FOR THE TWO TREATMENT ALTERNATIVES, WITH TWO MONTHS FOR ALTERNATIVE 3 AND ONE MONTH FOR ALTERNATIVE 4. THE TIME REQUIRED FOR REMEDIAL DESIGN AND PROCUREMENT WOULD BE APPROXIMATELY 12 MONTHS FOR BOTH ALTERNATIVES, BUT THE TREATABILITY STUDY NECESSARY FOR ALTERNATIVE 4 WOULD TAKE AN ADDITIONAL 6 MONTHS.

8.6 IMPLEMENTABILITY

IMPLEMENTABILITY REFERS TO THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF AN ALTERNATIVE, INCLUDING THE AVAILABILITY OF MATERIALS AND SERVICES NEEDED TO IMPLEMENT THE CHOSEN SOLUTION. IT ALSO INCLUDES COORDINATION OF FEDERAL, STATE, AND LOCAL GOVERNMENTS TO CLEAN UP THE SITE.

ALTERNATIVE 1 IS THE LEAST DIFFICULT ALTERNATIVE TO IMPLEMENT BECAUSE NO WORK IS NECESSARY. THE INSTITUTIONAL CONTROLS INCLUDED IN ALTERNATIVE 2 WOULD BE RELATIVELY EASY TO IMPLEMENT BY FEDERAL, STATE, AND LOCAL OFFICIALS, AND/OR THE PROPERTY OWNERS. TRANSPORTATION OF POTABLE WATER WOULD CONTINUE USING THE ESTABLISHED METHODS. GROUNDWATER MONITORING WOULD BE PERFORMED USING THE PREVIOUSLY INSTALLED MONITORING WELLS AND THE EXISTING SPRINGS.

THE CARBON ADSORPTION TREATMENT SYSTEM INCLUDED IN ALTERNATIVE 3 IS RELATIVELY EASY TO IMPLEMENT BECAUSE CARBON ABSORBERS ARE AVAILABLE AS OFF-THE-SHELF ITEMS FROM MANY VENDORS. CONSTRUCTION OF THE SYSTEM SHOULD NOT POSE MAJOR PROBLEMS UNLESS THE BEDROCK IS SHALLOW SUCH THAT IT IMPEDES THE INSTALLATION OF UNDERGROUND PIPING. IF THIS IS THE CASE,INSULATION OR SOIL COVERS COULD BE USED TO PROTECT THE PIPING FROM FREEZING DURING THE WINTER.

CARBON ADSORPTION IS A PROVEN AND RELIABLE TECHNOLOGY FOR TREATMENT OF VOCS. THE OPERATION OF THE SYSTEM WOULD REQUIRE PERIODIC SAMPLING OF THE INFLUENT AND EFFLUENT, REPLACING THE CARBON CANISTERS, CLEANING THE CISTERN AND SAND/GEOTEXTILE FILTER, AND REGENERATION OR TREATMENT/DISPOSAL OF THE SPENT CARBON FILTERS. CONSEQUENTLY, OPERATION AND MAINTENANCE OF THE SYSTEM WOULD REQUIRE A LONG-TERM COMMITMENT FROM STATE AND LOCAL AGENCIES. FUTURE REMEDIAL ACTIONS, IF NECESSARY, WOULD BE RELATIVELY EASY TO IMPLEMENT SINCE THE CARBON ABSORBERS ARE REMOVABLE.

THE AERATION SYSTEM INCLUDED IN ALTERNATIVE 4 IS ALSO RELATIVELY EASY TO IMPLEMENT. THE AERATION ZONE COULD BE CONSTRUCTED WITH SMALL POWER EQUIPMENT SINCE HEAVY EQUIPMENT CANNOT ACCESS THE SPRING, AND MATERIALS ARE READILY AVAILABLE FROM MULTIPLE VENDORS. OPERATION AND MAINTENANCE OF THIS TREATMENT SYSTEM WOULD BE LIMITED TO LONG-TERM MONITORING. HOWEVER, THIS SYSTEM IS INNOVATIVE AND A TREATABILITY STUDY IS NECESSARY TO DETERMINE THE DESIGN PARAMETERS AND TO QUANTIFY THE AIR EMISSIONS. DELAYS IN THE IMPLEMENTATION OF THIS ALTERNATIVE COULD ARISE AS A RESULT OF UNACCEPTABLE RISK ASSOCIATED WITH THE VOC EMISSIONS. MOREOVER, FUTURE REMEDIAL ACTIONS MAY BE DIFFICULT TO IMPLEMENT WITH THE AERATION ZONE IN PLACE.

8.7 COST

THIS CRITERION INVOLVES EVALUATION OF THE ESTIMATED CAPITAL (I.E., THE COST OF IMPLEMENTATION) AND OPERATION AND MAINTENANCE COSTS FOR EACH ALTERNATIVE. THE COSTS FOR THE FOUR ALTERNATIVES DEVELOPED FOR THE TRI-CITY SITE WERE ITEMIZED IN TABLE 19.

THERE ARE NO CAPITAL OR OPERATION AND MAINTENANCE COSTS ASSOCIATED WITH ALTERNATIVE 1 SINCE NO REMEDIAL ACTION WOULD BE IMPLEMENTED. THE CAPITAL COST FOR ALTERNATIVE 2 IS $880,798 AND THE TOTAL PRESENT WORTH OVER A 30-YEAR PERIOD IS ESTIMATED TO BE $1,714,000.

THE CAPITAL COSTS OF ALTERNATIVES 3 AND 4 ARE $904,254 AND $1,080,743, RESPECTIVELY. THE TOTAL PRESENT WORTH OVER A 30-YEAR PERIOD FOR THESE ALTERNATIVES IS $2,098,000 AND $1,990,000, RESPECTIVELY. WHILE THE "UP FRONT" COST IS HIGHER FOR ALTERNATIVE 4, THE TOTAL PRESENT WORTH IS SLIGHTLY LESS BECAUSE OPERATION AND MAINTENANCE IS MINIMAL.

8.8 STATE ACCEPTANCE

STATE ACCEPTANCE INDICATES WHETHER OR NOT, BASED ON ITS REVIEW OF THE RI AND FS REPORTS AND THE PROPOSED PLAN, THE COMMONWEALTH OF KENTUCKY CONCURS WITH, OPPOSES, OR HAS NO COMMENT ON EPA'S PREFERRED ALTERNATIVE.

BASED ON REVIEW OF THE RI AND FS REPORTS AND THE PROPOSED PLAN, THE COMMONWEALTH GENERALLY CONCURS WITH EPA'S SELECTED REMEDY FOR OPERABLE UNIT #1. ALTHOUGH THE COMMONWEALTH BELIEVES THAT A COMPLETE CHARACTERIZATION OF A SITE IS NECESSARY BEFORE A SUCCESSFUL STRATEGY FOR REMEDIATION CAN BE PLOTTED, THEY WILL CONSIDER THE SUCCESSFUL REMEDIATION OF OPERABLE UNIT #1 AS A FIRST STEP IN THE COMPLETE REMEDIATION OF THE TRI-CITY SITE.

THE COMMONWEALTH ALSO CONTINUES TO MAINTAIN THAT THE STATUTE KRS 224.877 IS A STATE ARAR THAT IS MORE STRINGENT THAN FEDERAL REQUIREMENTS. HOWEVER, IF EPA MEETS THE CRITERIA OUTLINED IN SECTION 10 OF KRS 224.877, THE COMMONWEALTH BELIEVES THAT EPA WILL HAVE COMPLIED WITH THE REQUIREMENTS OF THE STATUTE. SPECIFICALLY, SECTION 10 OF KRS 224.877 STATES THAT "THE REMEDIAL ACTION SHALL

PROTECT HUMAN HEALTH, SAFETY, AND THE ENVIRONMENT CONSIDERING THE FOLLOWING FACTORS AS APPROPRIATE:

(A) THE CHARACTERISTICS OF THE SUBSTANCE, POLLUTANT, OR CONTAMINANT, INCLUDING ITS TOXICITY, PERSISTENCE, ENVIRONMENTAL FATE AND TRANSPORT DYNAMICS, BIOACCUMULATION, BIOMAGNIFICATION, AND POTENTIAL FOR SYNERGISTIC INTERACTION AND WITH SPECIFIC REFERENCE TO THE ENVIRONMENT IN WHICH THE SUBSTANCE, POLLUTANT, OR CONTAMINANT HAS BEEN RELEASED;

(B) THE HYDROGEOLOGIC CHARACTERISTICS OF THE FACILITY AND THE SURROUNDING AREA;

(C) THE PROXIMITY, QUALITY, AND CURRENT AND FUTURE USES OF SURFACE WATER AND GROUNDWATER;

(D) THE POTENTIAL EFFECTS OF RESIDUAL CONTAMINATION OF POTENTIALLY IMPACTED SURFACE WATER AND GROUNDWATER;

(E) THE CHRONIC AND ACUTE HEALTH EFFECTS AND ENVIRONMENTAL CONSEQUENCES TO TERRESTRIAL AND AQUATIC LIFE OF EXPOSURE TO THE HAZARDOUS SUBSTANCE, POLLUTANT OR CONTAMINANT THROUGH DIRECT AND INDIRECT PATHWAYS;

(F) AN EXPOSURE ASSESSMENT; AND

(G) ALL OTHER AVAILABLE INFORMATION."

EPA DOES NOT AGREE THAT KRS 224.877 IS A STATE ARAR BECAUSE IT DOES NOT CONTAIN ANY SPECIFIC, ENFORCEABLE REQUIREMENTS THAT ARE MORE STRINGENT THAN PROVIDED BY FEDERAL LAW. NONETHELESS, EPA BELIEVES THAT THE SELECTED REMEDY COMPLIES WITH THE REQUIREMENTS OF KRS 224.877 BECAUSE IT IS PROTECTIVE OF HUMAN HEALTH, SAFETY, AND THE ENVIRONMENT TAKING THE STATUTORY FACTORS INTO CONSIDERATION THROUGH THE PERFORMANCE OF A REMEDIAL INVESTIGATION, A FEASIBILITY STUDY, AND A BASELINE RISK ASSESSMENT. AND, AS STATED IN THIS RECORD OF DECISION, THE RISK TO HUMAN HEALTH AND THE ENVIRONMENT ASSOCIATED WITH CONTAMINATION IDENTIFIED DURING THE CONFIRMATORY SAMPLING WILL BE RE-EVALUATED BASED ON THE ADDITIONAL SAMPLING DATA. SINCE THE COMMONWEALTH DID NOT SUBMIT RELY COMMENTS ON THE BASELINE RISK ASSESSMENT, THEIR CONCERNS WILL BE CONSIDERED DURING THERE-EVALUATION.

THE LETTER CONTAINING THE COMMONWEALTH'S COMMENTS ON THE DRAFT RECORD OF DECISION IS INCLUDED IN APPENDIX B.

8.9 COMMUNITY ACCEPTANCE

COMMUNITY ACCEPTANCE INDICATES THE PUBLIC SUPPORT OF A GIVEN ALTERNATIVE. COMMUNITY ACCEPTANCE OF THE VARIOUS ALTERNATIVES IS EVALUATED IN THE RESPONSIVENESS SUMMARY INCLUDED IN THIS DOCUMENT IN APPENDIX C. THE RESPONSIVENESS SUMMARY PROVIDES A THOROUGH REVIEW OF THE COMMENTS EPA RECEIVED ON THE RI AND FS REPORTS AND THE PROPOSED PLAN DURING THE PUBLIC MEETING AND THE PUBLIC COMMENT PERIOD.

#SR

9.0 THE SELECTED REMEDY

THE INVESTIGATIONS AT THE TRI-CITY SITE HAVE SHOWN THAT THE COX AND KLAPPER SPRINGS HAVE CONTAINED LEVELS OF VOLATILE ORGANIC COMPOUNDS IN EXCESS OF MCLS. BOTH SPRINGS HAVE BEEN USED AS SOURCES OF POTABLE WATER BY ON-SITE RESIDENTS. AT THIS TIME, HOWEVER, ONLY THE COX SPRING CONTAINS CONTAMINANT LEVELS IN EXCESS OF MCLS AND NON-ZERO MCLGS. BASED UPON CONSIDERATION OF THE REQUIREMENTS OF CERCLA, THE DETAILED ANALYSIS OF THE ALTERNATIVES, AND PUBLIC COMMENTS, EPA HAS SELECTED ALTERNATIVE 3, WHICH INCLUDES TREATMENT OF THE CONTAMINATED SPRING WATER IN A

CARBON ADSORPTION SYSTEM, AS THE PREFERRED METHOD OF ADDRESSING OPERABLE UNIT #1 AT THE TRI-CITY SITE. CARBON ADSORPTION IS A WELL-PROVEN, RELIABLE TECHNOLOGY THAT WOULD BE EFFECTIVE FOR REMOVING THE VOLATILE ORGANIC COMPOUNDS FROM THE SPRING WATER. REMOVAL EFFICIENCIES AS HIGH AS 99 PERCENT COULD POTENTIALLY BE ACHIEVED FOR THESE CONTAMINANTS.

ALTERNATIVE 3 WILL INVOLVE THE FOLLOWING SPECIFIC ACTIVITIES:

(1) INSTITUTIONAL CONTROLS TO RESTRICT THE POTABLE USE OF GROUNDWATER CONTAINING, OR POTENTIALLY CONTAINING, LEVELS OF CONTAMINATION IN EXCESS OF MCLS AND NON-ZERO MCLGS. INSTITUTIONAL CONTROLS MAY INCLUDE LOCAL ORDINANCES, CONSERVATION OR RESTRICTIVE EASEMENTS, RECORD NOTICE, OR SOME OTHER APPROPRIATE MEASURE. THE RESTRICTIONS WILL REMAIN IN EFFECT UNTIL EPA, THROUGH MONITORING, DETERMINES THAT THE WATER IS OF SUFFICIENT AND CONSISTENT QUALITY FOR HUMAN CONSUMPTION.

(2) CONTINUED PROVISION OF POTABLE WATER TO RESIDENTS WHO PREVIOUSLY USED CONTAMINATED GROUNDWATER AS A SOURCE OF POTABLE WATER. WATER WILL BE SUPPLIED UNTIL EPA, THROUGH MONITORING, DETERMINES THAT THE WATER IS OF SUFFICIENT AND CONSISTENT QUALITY FOR HUMAN CONSUMPTION.

(3) LONG-TERM MONITORING OF THE GROUNDWATER, SURFACE WATER, SEDIMENT, AND ECOLOGY. SINCE THE ON-SITE SPRINGS HAVE BEEN HISTORICALLY USED FOR POTABLE WATER, LONG-TERM MONITORING IS PROPOSED TO ENSURE THAT CONTAMINANT LEVELS REMAIN BELOW MCLS AND NON-ZERO MCLGS. FIVE OF THE ON-SITE SPRINGS (COX, KLAPPER, BRADING #2, CATTLE, AND THE UNNAMED SPRING) WILL BE MONITORED QUARTERLY FOR THE FIRST YEAR TO IDENTIFY SEASONAL VARIATIONS IN CONTAMINANT LEVELS, SEMI-ANNUALLY FOR THE NEXT TWO YEARS, AND YEARLY THEREAFTER FOR UP TO 27 YEARS. IN ADDITION TO CONTINUOUS REVIEWS FOR ANY PUBLIC HEALTH CONCERNS, THE DATA FROM THE SPRING SAMPLING WILL BE REVIEWED TO IDENTIFY CONTAMINANT LEVELS THAT WARRANT REMEDIAL ACTION. IF TREATMENT OF ANY OF THE OTHER ON-SITE SPRINGS, IN ADDITION TO THE COX SPRING, IS DETERMINED TO BE NECESSARY, IT WILL BE INCLUDED IN OPERABLE UNIT #1.

THE GROUNDWATER WILL BE MONITORED FOR UP TO 30 YEARS VIA ANNUAL SAMPLING OF THE EXISTING WELLS. THE SURFACE WATER AND SEDIMENT OF BRUSHY FORK CREEK WILL ALSO BE MONITORED VIA ANNUAL SAMPLING FOR UP TO 30 YEARS. THE SAMPLING RESULTS WILL BE REVIEWED EVERY FIVE YEARS FOR POSSIBLE ALTERATIONS IN THE MONITORING PROGRAM.

AN ECOLOGICAL CONTAMINANT MONITORING PROGRAM INVOLVING BIOASSAYS ANDTISSUE ANALYSES WILL BE CONDUCTED AT THE SITE. THIS PROGRAM WILL CONSIST OF THREE MONITORING EPISODES OVER THE FIVE-YEAR PERIOD FOLLOWING IMPLEMENTATION OF THE REMEDY. THE INITIAL MONITORING EPISODE WILL BE CONDUCTED CONCURRENTLY WITH THE CONFIRMATORY SAMPLING DURING THE RD PHASE TO ESTABLISH BASELINE CONDITIONS. THE SECOND MONITORING EPISODE WILL BE CONDUCTED ONE YEAR LATER TO IDENTIFY ANY SHORT-TERM SITE-RELATED IMPACTS. THE THIRD MONITORING EPISODE WILL BE CONDUCTED FIVE YEARS AFTER IMPLEMENTATION OF THE REMEDY TO IDENTIFY ANY LONG-TERM SITE-RELATED IMPACTS. THE MONITORING EPISODES WILL ALSO BE CONDUCTED DURING DIFFERENT SEASONS TO BE REPRESENTATIVE OF SITE CONDITIONS. IF THE MONITORING EPISODES INDICATE THAT SITE-RELATED ECOLOGICAL DEGRADATION HAS OCCURRED (OR IS OCCURRING), HISTOPATHOLOGICAL STUDIES MAY BE NECESSARY TO FURTHER DEFINE THE IMPACT. THE ADDITIONAL MEASURES NECESSARY TO MITIGATE THE THREAT TO THE ENVIRONMENT WILL BE IMPLEMENTED IN OPERABLE UNIT #2.

(4) CONFIRMATORY SAMPLING TO ASSESS THE EFFECTIVENESS OF THE EMERGENCY REMOVAL ACTION CONDUCTED NEAR THE COX, SR. RESIDENCE. THE APPARENTLY DISTURBED AREAS IN THE NORTHERN PORTION OF THE SITE (AS SHOWN IN THE EPIC AERIAL PHOTOGRAPH TAKEN IN 1967)

WILL BE ALSO SAMPLED TO INVESTIGATE POSSIBLE CONTAMINATION FROM DRUM DISPOSAL.

THE SURFACE SOILS ALONG THE EASTERN EDGE OF THE FORMER DISPOSAL AREA WHERE THE PASS AND ONE SPECIES OF PCB WERE FOUND DURING THE RI WILL ALSO BE SAMPLED TO ESTABLISH THE EXTENT OF ANY PAS AND PCB CONTAMINATION.

THE SEDIMENT IN THE TRIBUTARY TO BRUSHY FORK CREEK WHERE THE SAMPLE CONTAINING LEVELS OF CHROMIUM AND LEAD SUBSTANTIALLY ABOVE THE ER-L VALUES WAS COLLECTED DURING THE RI WILL BE INCLUDED IN THE CONFIRMATORY SAMPLING PROGRAM TO DETERMINE THE EXTENT OF THE CONTAMINATION. THE SEDIMENT SAMPLING WILL EXTEND TO THE LOCATION OF THE DOWNSTREAM SEDIMENT SAMPLE THAT CONTAINED A LEVEL OF LEAD IN EXCESS OF THE ER-L VALUE. ADDITIONAL AIR SAMPLING ALONG THE SLOPES OF THE COX LOBE WILL BE CONDUCTED TO IDENTIFY THE SOURCE OF THE PCE DETECTED DURING THE RI.

(5) TREATMENT OF THE CONTAMINATED WATER IN THE COX SPRING IN A CARBO ADSORPTION SYSTEM. THE TREATMENT SYSTEM WILL CONSIST OF MODIFICATIONS TO THE EXISTING CISTERN AND PIPING TO A DISPOSABLE ACTIVATED CARBON CANISTER. THE CISTERN WILL EQUALIZE THE CONTAMINANT CONCENTRATIONS AND A SAND/GEOTEXTILE FILTER WILL COLLECT ANY LARGE PARTICULATES IN THE SPRING WATER. THE SPRING WATER WILL THEN FLOW TO THE CARBON CANISTER BY GRAVITY. A PRELIMINARY DIAGRAM OF THE TREATMENT SYSTEM IS SHOWN IN FIGURE 18.

THE SYSTEM WILL BE DESIGNED TO HANDLE AN ESTIMATED AVERAGE YEAR-ROUND FLOW OF 2.5 GALLONS PER MINUTE (GPM). THE FLOW RATE OF THE COX SPRING HAS BEEN ESTIMATED TO BE ONE (1) GPM DURING THE DRY SEASON AND 5 GPM MAXIMUM DURING WET WEATHER. SPECIFIC FLOW RATE CHARACTERISTICS OF THE COX SPRING WILL BE CONFIRMED DURING THE REMEDIAL DESIGN PHASE.

THE POINT OF COMPLIANCE FOR ARARS HAS BEEN DETERMINED TO BE WHERE THE GROUNDWATER DISCHARGES TO THE SURFACE AS SPRINGS. REMEDIATION OF A CLASS II AQUIFER IS REQUIRED TO MEET MCLS AND NON-ZERO MCLGS AS ESTABLISHED UNDER THE SAFE DRINKING WATER ACT. THE TREATED WATER WILL BE DISCHARGED TO THE DOWNSTREAM TRIBUTARY. THIS DISCHARGE WILL BE REQUIRED TO MEET THE NPDES STANDARDS ESTABLISHED BY THE CLEAN WATER ACT AND REGULATED BY THE COMMONWEALTH OF KENTUCKY. THE CARBON CANISTER WILL BE SIZED TO TREAT THE CONTAMINANT LEVELS TO THESE STANDARDS. THE SPECIFIC PERFORMANCE STANDARDS FOR GROUNDWATER TREATMENT HAVE BEEN DISCUSSED IN SECTION 7.3 OF THIS RECORD OF DECISION DOCUMENT.

MONTHLY MONITORING OF THE INFLUENT AND EFFLUENT WILL BE REQUIRED FOR THE FIRST YEAR TO DETERMINE THE FREQUENCY OF CARBON REPLACEMENT. BASED ON AN ESTIMATED AVERAGE YEAR-ROUND FLOW OF 2.5 GPM, A REPLACEMENT RATE OF ONE CANISTER CONTAINING 150 POUNDS OF CARBON EVERY TWO MONTHS IS ANTICIPATED. THIS ESTIMATE WILL BE VERIFIED DURING THE FIRST YEAR OF MONITORING. FOR UP TO THE FOLLOWING 29 YEARS, THE INFLUENT AND EFFLUENT WILL BE SAMPLED PRIOR TO CARBON REPLACEMENT.

THE SPENT CARBON WILL BE REGENERATED OR TREATED/DISPOSED OFF-SITE. EVALUATION FOR THE TOXICITY CHARACTERISTIC WILL BE NECESSARY TO ENSURE THAT THE APPLICABLE SUBTITLE C OR D REQUIREMENTS OF RCRA ARE MET. AN ESTIMATED 900 POUNDS PER YEAR OF CONTAMINATED CARBON IS EXPECTED TO BE GENERATED BY THE TREATMENT SYSTEM.

IN ADDITION TO THE ABOVE ACTIVITIES, VARIOUS SUPPORT ACTIVITIES INCLUDING THE IMPLEMENTATION OF A WORKER HEALTH AND SAFETY PROGRAM AND ENVIRONMENTAL MONITORING FOR INDICATOR CHEMICAL EMISSIONS WILL BE CONDUCTED.

THE ESTIMATED COST OF ALTERNATIVE 3 WAS SHOWN IN TABLE 19. THE TOTAL PRESENT WORTH IS APPROXIMATELY $2,098,000 WITH AN ESTIMATED CAPITAL COST OF $904,254. THE TIME REQUIRED TO IMPLEMENT THIS ALTERNATIVE IS EXPECTED TO BE 14 MONTHS, WHICH INCLUDES 12 MONTHS FOR REMEDIAL DESIGN AND PROCUREMENTS AND TWO MONTHS FOR CONSTRUCTION.

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10.0 THE STATUTORY DETERMINATIONS

UNDER ITS LEGAL AUTHORITIES, EPA'S PRIMARY RESPONSIBILITY AT SUPERFUND SITES IS TO UNDERTAKE REMEDIAL ACTIONS THAT PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. IN ADDITION, SECTION 121 OF CERCLA ESTABLISHES SEVERAL OTHER STATUTORY REQUIREMENTS AND PREFERENCES. ONE OF THE REQUIREMENTS SPECIFIES THAT WHEN COMPLETE, THE SELECTED REMEDIAL ACTION FOR THE SITE MUST COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL STANDARDS ESTABLISHED UNDER FEDERAL AND STATE ENVIRONMENTAL LAWS UNLESS A WAIVER IS JUSTIFIED. THE SELECTED REMEDY MUST ALSO BE COST EFFECTIVE AND UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. FINALLY, THE STATUTE INCLUDES A PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT THAT PERMANENTLY AND SIGNIFICANTLY REDUCE THE VOLUME, TOXICITY, OR MOBILITY OF HAZARDOUS WASTES AS THEIR PRINCIPAL ELEMENT. THE FOLLOWING DISCUSSIONS ADDRESS HOW THE SELECTED REMEDY MEETS THESE STATUTORY REQUIREMENTS.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

BASED ON THE BASELINE RISK ASSESSMENT, THE PRIMARY HEALTH RISK IS FROM THE POTENTIAL USE OF THE CONTAMINATED GROUNDWATER AS A SOURCE OF POTABLE WATER. THIS RISK IS DUE TO THE PRESENCE OF VOCS AT LEVELS IN EXCESS OF THE MAXIMUM CONTAMINANT LEVELS (MCLS) ESTABLISHED BY THE SAFE DRINKING WATER ACT.

THE SELECTED REMEDY PROTECTS HUMAN HEALTH AND THE ENVIRONMENT BY TREATING THE CONTAMINATED GROUNDWATER IN A CARBON ADSORPTION SYSTEM. IT IS NOT PRACTICABLE TO EXTRACT GROUNDWATER FOR TREATMENT BECAUSE OF THE HYDROGEOLOGIC CONDITIONS AT THE SITE, SO THE CONTAMINATED GROUNDWATER WILL BE TREATED AS IT DISCHARGES TO THE SURFACE AS SPRINGS.

THE CONTAMINANTS WILL BE PERMANENTLY REMOVED FROM THE GROUNDWATER BY THE ACTIVATED CARBON FILTRATION SYSTEM. THE SPENT CARBON WILL THEN BE TRANSPORTED OFF-SITE FOR REGENERATION OR TREATMENT AND DISPOSAL.

TREATMENT OF THE CONTAMINATED GROUNDWATER WILL CONTINUE UNTIL CONTAMINANT LEVELS IN THE INFLUENT DECREASE TO BELOW MCLS AND NON-ZERO MCLGS BY NATURAL PROCESSES. IT IS ANTICIPATED THAT THE VOC LEVELS WILL DECREASE TO NEAR OR BELOW MCLS AND NON-ZERO MCLGS WITHIN TEN YEARS.

TREATMENT OF THE CONTAMINATED GROUNDWATER TO MCLS AND NON-ZERO MCLGS WILL REDUCE THE CARCINOGENIC RISK TO 1.4E-4 AND THE HAZARD INDEX TO LESS THAN ONE (1). THESE LEVELS ARE WITHIN EPA'S ACCEPTABLE RISK RANGE OF E-4 TO E-6 AND A HAZARD INDEX OF LESS THAN ONE (1).

THE BASELINE RISK ASSESSMENT ALSO REVEALED A POTENTIAL RISK ASSOCIATED WITH RAISING BEEF CATTLE AND CULTIVATING GARDENS ON-SITE. HOWEVER, THIS POTENTIAL RISK IS BASED ON THE DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS (PASS) AND ONE SPECIES OF PCB IN ONE OUT OF THE TWENTY SURFACE SOIL SAMPLES COLLECTED DURING THE RI. THE EXTENT OF PCB AND PAS CONTAMINATION IN SURFACE SOILS WILL BE DETERMINED DURING THE CONFIRMATORY SAMPLING. THE ASSOCIATED RISKS WILL BE RE-EVALUATED BASED ON THE NEW DATA.

TETRACHLOROETHENE (ALSO KNOWN AS PERCHLOROETHYLENE, OR PCE) WAS DETECTED IN ONLY TWO OF THE TWELVE AMBIENT AIR SAMPLES COLLECTED ON-SITE DURING THE RI. ALTHOUGH THE RISK ASSOCIATED WITH

THIS EXPOSURE PATHWAY WAS WITHIN EPA'S ACCEPTABLE RISK RANGE, THE NONCARCINOGENIC HAZARD QUOTIENT EXCEEDED UNITY. SINCE A SOURCE OF THE PCE CONTAMINATION IN THE AIR HAS NOT BEEN IDENTIFIED, ADDITIONAL SAMPLING WILL BE CONDUCTED TO DETERMINE IF A SOURCE OF THE PCE EXISTS. THE RISKS ASSOCIATED WITH THE AIR PATHWAY WILL BE RE-EVALUATED BASED ON THE NEW DATA.

THE SEDIMENT SAMPLING CONDUCTED DURING THE RI REVEALED LEVELS OF CHROMIUM AND LEAD IN ONE SAMPLE THAT SUBSTANTIALLY EXCEEDED EFFECTS LEVELS ESTIMATED BY NOAA FOR AQUATIC BIOTA. CONSEQUENTLY, THE EXTENT OF INORGANIC CONTAMINATION WILL BE VERIFIED DURING THE CONFIRMATORY SAMPLING.

NO UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS ARE ANTICIPATED TO BE CAUSED BY IMPLEMENTATION OF THE SELECTED REMEDY.

10.2 COMPLIANCE WITH ARARS

THE SELECTED REMEDY INVOLVING TREATMENT OF CONTAMINATED GROUNDWATER USING CARBON ADSORPTION, INSTITUTIONAL CONTROLS, THE PROVISION OF POTABLE WATER, LONG-TERM MONITORING, AND CONFIRMATORY SAMPLING WILL COMPLY WITH ALL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS). THE ARARS FOR THE SELECTED REMEDY ARE LISTED BELOW.

CHEMICAL-SPECIFIC ARARS

FEDERAL: CLEAN WATER ACT

- NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (40 CFR PART 122)
- WATER QUALITY STANDARDS (40 CFR PART 131)
- AMBIENT WATER QUALITY CRITERIA (SECTION 304(A) (1) OF THE CLEAN WATER ACT)

SAFE DRINKING WATER ACT

- MAXIMUM CONTAMINANT LEVELS (MCLS) (40 CFR PART 141)
- MAXIMUM CONTAMINANT LEVEL GOALS (MCLGS) (40 CFR PART 141, 50 FR 46936

STATE: 401 KAR 5:031 - SURFACE WATER STANDARDS

ACTION-SPECIFIC ARARS

FEDERAL: RESOURCE CONSERVATION AND RECOVERY ACT

- 40 CFR PART 262 (GENERATORS & TEMPORARY STORAGE)
- 40 CFR PART 263 (MANIFESTS & TRANSPORTATION)
- 40 CFR PART 264 (STORAGE)

CLEAN AIR ACT (40 CFR PARTS 50-62)

OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

- HEALTH AND SAFETY STANDARDS FOR EMPLOYEES ENGAGED IN HAZARDOUS WASTE OPERATIONS (54 FR 9294)

US DEPARTMENT OF TRANSPORTATION'S HAZARDOUS MATERIALS TRANSPORTATION ACT OF 1990

STATE: 401 KAR 63:020 - POTENTIALLY HAZARDOUS MATTER OR TOXIC SUBSTANCES
401 KAR 5:035 - TREATMENT REQUIREMENTS
601 KAR 1:025 - TRANSPORTING HAZARDOUS MATERIALS
KRS 174-415 - HAZARDOUS MATERIAL: PERMITS, EMERGENCY PROCEDURES, ENFORCEMENT

10.3 COST EFFECTIVENESS

THE SELECTED ALTERNATIVE, ALTERNATIVE 3, IS COST-EFFECTIVE BECAUSE IT HAS BEEN DETERMINED TO PROVIDE OVERALL EFFECTIVENESS PROPORTIONAL TO THE COST. CARBON ADSORPTION IS A PROVEN, RELIABLE, AND EASILY IMPLEMENTABLE TECHNOLOGY FOR THE TREATMENT OF VOCS IN WATER. MINIMAL RISK IS ASSOCIATED WITH IMPLEMENTATION AND THE OPERATION AND MAINTENANCE OF THE TREATMENT SYSTEM. THE TOTAL PRESENT WORTH OF ALTERNATIVE 3 IS $2,098,000.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA HAS DETERMINED THAT THE SELECTED REMEDY REPRESENTS THE MAXIMUM EXTENT TO WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST-EFFECTIVE MANNER FOR OPERABLE UNIT ONE AT THE TRI-CITY SITE. OF THE ALTERNATIVES THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND THAT COMPLY WITH ARARS, EPA HAS DETERMINED THAT THE SELECTED REMEDY PROVIDES THE BEST BALANCE OF TRADEOFFS WITH RESPECT TO LONG-TERM EFFECTIVENESS AND PERMANENCE, REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT, SHORT-TERM EFFECTIVENESS, IMPLEMENTABILITY, AND COST WHILE CONSIDERING STATE AND COMMUNITY ACCEPTANCE.

THE SELECTED REMEDY UTILIZES A CARBON ADSORPTION TREATMENT SYSTEM, WHICH IS A PROVEN AND RELIABLE TECHNOLOGY FOR THE REMOVAL OF VOCS FROM WATER. CONSEQUENTLY, THIS ALTERNATIVE WOULD BE EFFECTIVE IN MITIGATING THE RISK ASSOCIATED WITH THE CONTAMINATED GROUNDWATER.

TREATMENT IN THE CARBON ADSORPTION SYSTEM WOULD REDUCE THE MOBILITY OF CONTAMINANTS BY TRANSFERRING THE VOCS TO THE ACTIVATED CARBON. THE TOXICITY AND VOLUME OF THE CONTAMINANTS WOULD BE REDUCED WHEN THE SPENT CARBON IS REMOVED FROM THE SITE FOR REGENERATION OR TREATMENT PRIOR TO DISPOSAL AT AN APPROVED FACILITY.

THE CARBON ADSORPTION SYSTEM IS RELATIVELY EASY TO IMPLEMENT AND THE LIMITED CONSTRUCTION WOULD RESULT IN MINIMAL RISK TO WORKERS AND THE COMMUNITY. THE TREATMENT SYSTEM WOULD ALSO REQUIRE MINIMAL OPERATOR ATTENTION, SUCH AS PERIODIC SAMPLING AND REPLACEMENT OF THE CARBON CONTAINERS.

THE SELECTED REMEDY, IN COMPARISON WITH THE OTHER TREATMENT ALTERNATIVE CONSIDERED, IS MORE RELIABLE AND EASIER TO IMPLEMENT. IT WILL SIGNIFICANTLY REDUCE THE TOXICITY, MOBILITY, AND VOLUME OF HAZARDOUS SUBSTANCES ON-SITE. AND, IT IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THEREFORE, IT HAS BEEN DETERMINED TO BE THE MOST APPROPRIATE REMEDY FOR THE CONTAMINATED GROUNDWATER AT THE TRI-CITY SITE.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

EPA HAS DETERMINED THAT ALTERNATIVE 3, WHICH INCLUDES TREATMENT OF CONTAMINATED GROUNDWATER IN A CARBON ADSORPTION SYSTEM, SATISFIES THE STATUTORY REFERENCE FOR REMEDIES THAT EMPLOY TREATMENT AND MEETS THE EXPECTATIONS IN THE NCP REGARDING RESTORATION OF GROUNDWATER TO ITS BENEFICIAL USES WITHIN A REASONABLE TIME FRAME.

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TABLE 2
CURRENT AND PROPOSED MCLS AND MCLGS (IN PPB)

PURGEABLE ORGANICS	MCL	MCLG
CHLOROFORM	100	---
1,1-DICHLOROETHENE	7	7
CIS-1,2-DICHLOROETHENE	70	70
TRANS-1,2-DICHLOROETHENE	100	100
TETRACHLOROETHENE (PCE)	5	0
TOLUENE	1,000	1,000
1,1,1-TRICHLOROETHANE	200	200
TRICHLOROETHENE	5	0
VINYL CHLORIDE	2	0
XYLENES	10,000	10,000
EXTRACTABLE ORGANICS		
BIS (2-ETHYLHEXYL) PHTHALATE	4*	0*
INORGANICS		
CADMIUM	5	5
LEAD	15**	0
NICKEL	100*	100*

* INDICATES A PROPOSED MCL OR MCLG
** INDICATES THE ACTION LEVEL ESTABLISHED IN 56 FR 26460, JUNE 7, 1991
-- INDICATES THAT A MCL OR MCLG HAS NOT BEEN ESTABLISHED

TABLE 10

RI SURFACE AND SUBSURFACE SOILS SAMPLING, 1989
TRI-CITY INDUSTRIAL DISPOSAL SITE, BROOKS, KENTUCKY
SUMMARY OF INORGANIC ANALYSES AS RANGES OF DATA (IN PPM)

CONTAMINANT	SURFACE SOILS	SUBSURFACE SOILS
ALUMINUM	4,400J - 190,000J	9,000-49,000
ARSENIC	4.5 - 19	4.1 - 31J
BARIUM	85 - 320	37 -370
BERYLLIUM	1.2 - 2.3	1.1 - 3.7
CADMIUM	2 - 4	4 - 13JN
CALCIUM	580 - 4,000	440J -14,000J
CHROMIUM	10 - 120	11 - 110
COBALT	11 -38	1.8J - 36J
COPPER	6.1 - 84J	7.6 - 37J
IRON	11,00 - 55,000	13,000J-62,000J
LEAD	16J - 66J	6J - 71
MAGNESIUM	310 - 2,600	700 - 22,000
MANGANESE	80J - 1,500	500 - 3,300
MERCURY	----------	----------
NICKEL	12 - 100	10 - 86J
POTASSIUM	420 - 1,500	500 - 3,300
SODIUM	260	250 - 330
VANADIUM	18 - 86	23 - 130
ZINC	37J - 130J	46J - 300J

J - INDICATES AN ESTIMATED VALUE
N - INDICATES PRESUMPTIVE EVIDENCE OF MATERIAL
-- INDICATES MATERIAL NOT DETECTED ABOVE MINIMUM QUANTITATION LIMIT

TABLE 11

EPA SURFACE SOILS INVESTIGATION, DECEMBER 1990
SUMMARY OF INORGANIC ANALYSES AS RANGES OF DATA (IN PPM)

CONTAMINANT	CONCENTRATION
ALUMINUM	6,300 - 8,600
ARSENIC	10U - 15U
BARIUM	67 - 94
BERYLLIUM	0.50U - 1.0U
CADMIUM	0.50U - 1.OU
CALCIUM	2,300 - 2,500
CHROMIJM	8.4 - 13
COBALT	6.7 - 11
COPPER	6.5 - 9.6
IRON	11,000 - 21,000
LEAD	16 - 17
MAGNESIUM	980 - 2,400
MANGANESE	660 - 910
MERCURY	0.06 - 0.10
NICKEL	12 - 23
POTASSIUM	600 - 920
SODIUM	100U - 200U
VANADIUM	14 - 20
ZINC	40 - 60

U - INDICATES MATERIAL WAS ANALYZED FOR BUT NOT DETECTED; THE NUMBER IS THE MINIMUM QUANTITATION LIMIT.

TABLE 18

SUMMARY OF ER-L CONCENTRATIONS
FOR METALS IN SEDIMENT

CONTAMINANT	ER-L CONCENTRATION	DEGREE OF CONFIDENCE
ARSENIC	33 PPM	LOW
CHROMIUM	80	MODERATE
LEAD	35	MODERATE
MERCURY	0.15	MODERATE
NICKEL	30	MODERATE

NA - NOT AVAILABLE

TABLE 19
SUMMARY OF COSTS FOR REMEDIAL ALTERNATIVES

ALTERNATIVE 1 - NO ACTION	
CAPITAL	$0
ANNUAL O&M	0
ECOLOGICAL COST	0
5-YEAR COST	0
TOTAL PRESENT WORTH	0
ALTERNATIVE 2 - LIMITED ACTION	
CAPITAL	$ 880,798
ANNUAL O&M	
1ST YEAR	56,396
2ND YEAR	46,026
3RD YEAR	46,026
4TH-30TH YEAR	40,842
POTABLE WATER SUPPLY	2,420
ECOLOGICAL COST	22,704
5-YEAR COST	10,000
TOTAL PRESENT WORTH	$ 1,714,000
ALTERNATIVE 3 - CARBON ADSORPTION	
CAPITAL	$ 904,254
ANNUAL O&M	
PROCESS MONITORING	
1ST YEAR	34,386
2ND-30TH YEAR	23,896
LONG-TERM MONITORING	
1ST YEAR	53,084
2ND-30 YEAR	44,370
3RD YEAR	44,370
4TH-30TH YEAR	40,014
POTABLE WATER SUPPLY	2,420
ECOLOGICAL COST	22,704
5-YEAR COST	10,000
TOTAL PRESENT WORTH	$ 2,098,000
ALTERNATIVE 4 - AERATION	
CAPITAL	$ 1,080,743
ANNUAL O&M	
PROCESS MONITORING	
1ST-5TH YEAR	$ 20,980
6TH-30TH YEAR	10,490
LONG-TERM MONITORING	
1ST YEAR	53,084
2ND YEAR	44,370
3RD YEAR	44,370
4TH-30TH YEAR	40,014
POTABLE WATER SUPPLY	2,420
ECOLOGICAL COST	22,704
5-YEAR COST	10,000
TOTAL PRESENT WORTH	$ 1,990,000

TABLE 20
SITE-SPECIFIC MCLS AND MCLGS (IN PPB)
TRI-CITY INDUSTRIAL DISPOSAL SITE, BROOKS, KENTUCKY

CONTAMINANTS OF CONCERN	MCL (1)	MCLG (2)	RISK OR HQ (3)
PURGEABLE ORGANICS			
CHLOROFORM	100	---	1.7E-5
1,1-DICHLOROETHENE 7	7		0.02
CIS-1,2-DICHLOROETHENE	70	70	0.2
TRANS-1,2-DICHLOROETHENE	100	100	0.14
TETRACHLOROETHENE (PCE)	5	0	7.5E-6
TOLUENE	1,000	1,000	0.14
1,1,1-TRICHLOROETHANE	200	200	0.07
TRICHLOROETHENE (TCE)	5	0	1.6E-6
VINYL CHLORIDE	2	0	1.1E-4
XYLENES	10,000	10,000	0.14
EXTRACTABLE ORGANICS			
BIS (2-ETHYLHEXYL) PHTHALATE	4*	0*	1.6E-6
	TOTAL CARCINOGENIC RISK		1.4E-4 (4)
	TOTAL HAZARD INDEX		0.71

(1) MAXIMUM CONTAMINANT LEVELS (MCLS) ARE ENFORCEABLE STANDARDS PROMULGATED UNDER THE SAFE DRINKING WATER ACT. THESE STANDARDS APPLY TO SPECIFIC CONTAMINANTS THAT EPA HAS DETERMINED TO HAVE AN ADVERSE EFFECT ON HUMAN HEALTH ABOVE CERTAIN LEVELS. MCLS ARE USED AS REMEDIATION LEVELS FOR CONTAMINANTS HAVING MCLS.

(2) MAXIMUM CONTAMINANT LEVEL GOALS (MCLGS) ARE NON-ENFORCEABLE HEALTH- BASED GOALS THAT ARE PROTECTIVE OF ADVERSE HUMAN HEALTH EFFECTS AND THAT ALLOW AN ADEQUATE MARGIN OF SAFETY.

(3) RISK LEVELS AND HAZARD QUOTIENTS ARE BASED ON THE INGESTION OF 2 LITERS OF WATER EVERY DAY BY A 70 KG PERSON FOR A LIFETIME (70 YEARS). RISK LEVELS ARE FOR CARCINOGENIC COMPOUNDS. HAZARD QUOTIENTS ARE FOR NON-CARCINOGENIC COMPOUNDS.

(4) THE MAJORITY OF THE RISK IS BASED ON THE MCL FOR VINYL CHLORIDE. THIS MCL IS SET AT THE DETECTION LIMIT, THEREFORE IT IS AS LOW AS POSSIBLY ATTAINABLE .

* INDICATES A PROPOSED MCL OR MCLG
-- INDICATES THAT A MCL OR MCLG HAS NOT BEEN ESTABLISHED